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Worcester Rain Gardens: Developing Promotional Materials for Rain Gardens in the City of Worcester

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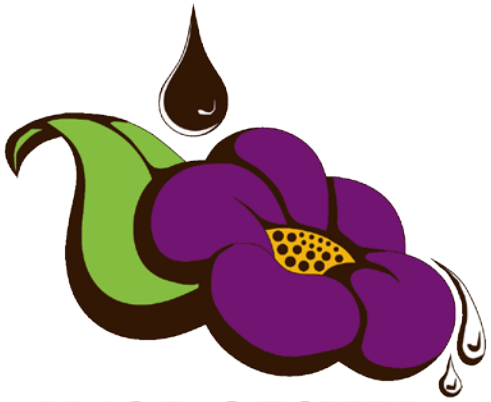

Developing Promotional Materials for Rain Gardens in the City of Worcester

Interactive Qualifying Project submitted to the faculty of

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by

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Submitted to:

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Executive Summary

Our project deals with creating promotional materials for rain gardens in the city of Worcester. These materials include a brochure, a video and a website. In their creation we take into consideration established design principles, common practices and direct input from our target audience. The purpose for creating these materials is to show homeowners in Worcester that by building rain gardens in their houses they can help reduce the flooding and water pollution problems in their homes and in the city of Worcester as a whole.

The city of Worcester has to deal with flooding and water pollution issues on a regular basis because of the vast number of impervious surfaces in the area. These surfaces such as roads, parking lots, buildings and driveways generate large volumes of storm water runoff. The challenges the city of Worcester faces due to the effects of storm water runoff have been an increasingly large problem. In many places around the city, the drainage pipes consist of a combined sewer system, which is an old infrastructure designed to collect rain water runoff and domestic sewage in a single pipe system. The combined sewer system cannot handle excessive amounts of rain water runoff, and this leads to flooding in various places around the city such as local streets and the basements of individual homes. During times of heavy precipitation, the volume of wastewater can exceed the capacity of the combined sewer system or treatment plant and the city is forced to discharge raw sewage into the Blackstone River.

The current condition of the Blackstone River can be traced back to the early nineteenth century when mills and factories were built along its banks. To this day, the river faces a long battle with pollution. One major cause of this continuous pollution is storm water runoff. As storm water runoff travels down impervious surfaces such as sidewalks, driveways, and parking lots, it carries with large amounts of pollutants and sediments. Many of these pollutants are

things that people use in their daily life such as the oil that drips from their car or the fertilizer they use on their lawn. Rain gardens have the ability to trap, absorb the pollutants, and filter this runoff back into the environment. By using rain gardens, as a form of green infrastructure which supports the existing grey infrastructure, people can make an individual response to a seemingly insurmountable problem.

Rain gardens are a great example of green infrastructure in the way it can complement the gray infrastructure of the sewer systems and storm water management. Rain gardens are landscaped areas incorporated with wild flowers and other native plants that absorb rain water runoff from roofs of houses or other impervious surfaces. Rain gardens fill up with inches of storm water and gradually filter it into the ground instead of allowing it to run off into local sidewalks, streets, and storm drains. Rain gardens are different from average landscaping in that rain gardens allow about thirty percent more water to soak into the ground. Rain gardens are important because as cities and suburbs grow, areas of vegetation are replaced with impervious surfaces. As impervious surfaces increase the amount of storm water that runs off into local streets and storm drains increases. For this reason, the storm water runoff must be intercepted before it causes significant problems.

In order to make a significant impact in reducing the problems caused by storm water runoff, rain gardens must be implemented in various areas throughout the city. The first promotional material that we created to convince homeowners of building a rain garden was a brochure. Our brochure is a way to persuade Worcester communities to build a rain garden and to incite behavioral change on environmental issues, especially those dealing with flooding and water pollution in the Blackstone River. The brochure would be designed to grab the attentions of Worcester communities who never know about rain garden before. With limited of the

brochure contents, the project team could not add much on sewage overflow and water pollution problem in Worcester, but we hope that the brochure can provide them a way to want to know more on these issues. Since brochure has strength in access through community with less technological requirement, brochure was selected to introduce rain garden and persuade Worcester's community to build one with enough information that they need in order to build and maintain a rain garden.

Our video, on the other hand, has a high ability to engage viewers and it is more ideal for discussing the flooding and water pollution problems. Videos can provide cognitive engagement and elicit an emotional response. We believe that by watching the actual situation of flooding and water pollution problem in Worcester, the target audiences can better realize and understand the problem. Therefore, with its strength on retaining peoples' attention, video is one of the best media to show the problem of sewage overflow in Worcester.

A website has less of a limitation than a brochure and a video for the amount of information it can transmit to the audience. For this reason, the website can provide stronger evidence that needs a more elaborate explanation for why rain gardens are a relevant infrastructure to be implemented in the city of Worcester. It can also provide a more ample catalogue of local resources so that visitors can more quickly and easily start making rain gardens in their own homes.

By having created a brochure, a video and a website, we hope that they can now be used to spread awareness throughout the city of Worcester of the flooding and water pollution issues and we also hope that they can help people realize that by making an individual effort they can contribute to overcoming a seemingly insurmountable problem.

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Chapter One: Overview of Our Project

Located in the heart of Massachusetts, the city of Worcester is a vibrant and culturally diverse city. Its residents and visitors can do various activities such as boat on lake Quinsigamond, visit numerous world-class museums and attend cultural and entertainment events of the many venues Worcester has to offer. It's a great place to live offering residents access to work in the exciting fields of healthcare and biotechnology, an exceptional educational system with internationally recognized universities and various community activities such as farmers markets and art fairs. Geographically, Worcester is located on top of many hills such as Airport Hill, Bancroft Hill and Belmont Hill, making the terrain very low in certain areas. Travelling through this hilly terrain is the Blackstone Valley River. The rivers headwaters are located in Worcester in Institute Park and travels through Massachusetts and Rhode Island, where it becomes tidal and its name changes to the Seekonk River.

As stated by the Environmental Protection Agency (EPA, 2011), the Blackstone Valley River is the most polluted river in the country with respect to toxic sediments. Beginning early in the 1800's when the first settlers made their living working in factories built along the Blackstone, to the present time, the river has faced a long battle with pollution. Due to the excessive rainwater runoff into the combined sewer system of the city of Worcester, significant amounts of flooding and pollutants are being transported into the Blackstone River. In periods of heavy rainfall, the combined sewer system reaches its maximum capacity, forcing the city to dump raw sewage into Blackstone River and assuming related fines by the EPA for violating the Clean Water Act regulations. This sewage overflow also means that the pollutants brought in by storm water runoff never reach the treatment plants and are not filtered out.

As well as the combined sewer system being overwhelmed, there are many sewers that do not travel to the water treatment plant. They are led straight into local ponds and streams, in turn reducing the quality of the water. In many areas around Worcester, there is a combined sewer system meaning that the storm drains and the sewer system are combined into one drain, which travels to the sewage treatment plant. When the water levels overwhelm the pipes and the treatment plant, many areas around Worcester flood making it difficult for residents on their daily commute and causing water damages to areas such as the basements of many homes. As well as all the flooding caused by this, the treatment plant will dump any excess sewage and runoff that it cannot take in to reduce the amount of the backup being caused by all the excess water. In the areas of Worcester where there is not a combined sewer system, the storm drains lead directly into the local streams and ponds,

The overall goal of this project was to demonstrate to people that the sewage overflow problem in the city of Worcester is an issue that affects every individual and requires the efforts of the community to help make a difference and improve the situation. We are trying to showcase rain gardens as a viable and economical option that can help alleviate the problem and inspire the community to use rain gardens on their own as a way to make a change. The smaller goals through the process of the project were to investigate the economic and health issues related to sewage overflow, assess people's awareness of sewage overflow problems to help determine the kind of information to include in our promotional materials, to adapt the findings of other promotional and environmental campaigns for their application in our project, to involve outside organizations, and to finally create an informational webpage, a promotional video, and brochures that can help spread awareness to large groups of people.

The mayor's office of Worcester as well as the Blackstone River Storm Water Coalition, has taken it upon themselves to aid in the success of this project. Both of these organizations together would like to make Worcester a greener community. In the spring of 2011, a large rain garden was constructed at the Worcester Youth Center as a demonstration to the residents of Worcester, showing the beauty and effectiveness of a rain garden. This garden has collected large quantities of water, which would normally cause the basement of the youth center to flood, and filtered it back into the environment. By kicking off this promotional campaign the mayor's office as well as the storm water coalition hope to target large communities, and more specifically homeowners to encourage them to make their own rain garden. They want to demonstrate that rain gardens are beneficial to them and that they can also help alleviate the flooding and pollution problems in areas around Worcester. Our project helps demonstrate to the Worcester community that rain gardens are in fact an effective, low cost, and beautiful landscaping technique to help alleviate storm water runoff. By creating these various forms of media, we hope that people will feel inspired to make their own rain garden with the various resources we have provided for them.

Each chapter of this report goes into detail about the background information surrounding the Blackstone River, storm water runoff, rain gardens, and the various steps our team took to design each of our outreach materials. In Chapter 2, our team gives the necessary background surrounding the Blackstone River, storm water runoff, rain gardens, and grey vs. green infrastructure. This will provide our readers with a deep understanding of the material that will be covered in our three forms of media.

Chapter 3 goes into detail about the various methods to create our informational media and detail about the dissemination of our media. This provided the group with the reasoning for

creating the forms of media that were created and how we plan to effectively transfer our findings to our target audience.

In Chapter 4, we explain in detail the process used to create the informational brochure. This is a necessary step in creating an effective brochure that will attract the target audience and help inspire them to make a difference in the community.

Chapter 5 gives information on the use and creation of promotional videos. This provided us with the information needed to create our own promotional video. Our promotional video shows the negative effects of storm water runoff and the how rain gardens are an effective and beautiful landscaping technique.

Chapter 6 describes the process and detail for creating an effective and informational webpage. There were many techniques and principles that needed to be followed in order to create a professional, appealing, and useful webpage.

Chapter Two: Storm Water Runoff and the Benefits of Rain Gardens

The challenges the city of Worcester faces due to the effects of storm water runoff have been an increasingly large problem. In many places around the city, the storm drains and the sewage pipes are connected, which can at times overflow and cause flooding in various places around the city such as local streets and the basements of individual homes. As well as having a combined sewer system, other areas have storm drain that lead directly into local streams and ponds without passing through the treatment plant. While many people can attribute this problem back to the city, there are many things that can be done on an individual level to help restore the condition of the Blackstone River.

The current condition of the Blackstone River can be traced back to its early days when it was used to power mills and factories built along its banks. As the years have passed, the condition has only grown worse. In this chapter we will provide the following information: 1. The history and current source of pollution in the Blackstone River in order to fully understand the severity of pollution that exists; 2. An over view of water pollution in Worcester and its affect on the Blackstone River, one major cause of this being storm water runoff; 3. The advertising and outreach techniques that will be used when creating the three forms of outreach used in this project; 4. The dissemination of information to the target audience; and finally 5. The use of rain gardens as a viable alternative for capturing storm water runoff so people can make an individual response to a seemingly surmountable problem.

2.1. The History and Current Source of Pollution in the Blackstone River

Pollution in the Blackstone River can date back to the 1700's, as said by Chafee (2009), Worcester was known as the birthplace of the American Revolution. As the population began to grow, the number of mills and factories built along the river for its waterpower also grew. The first successful factory, a water powered cotton-spinning factory, was built by Samuel Slater.

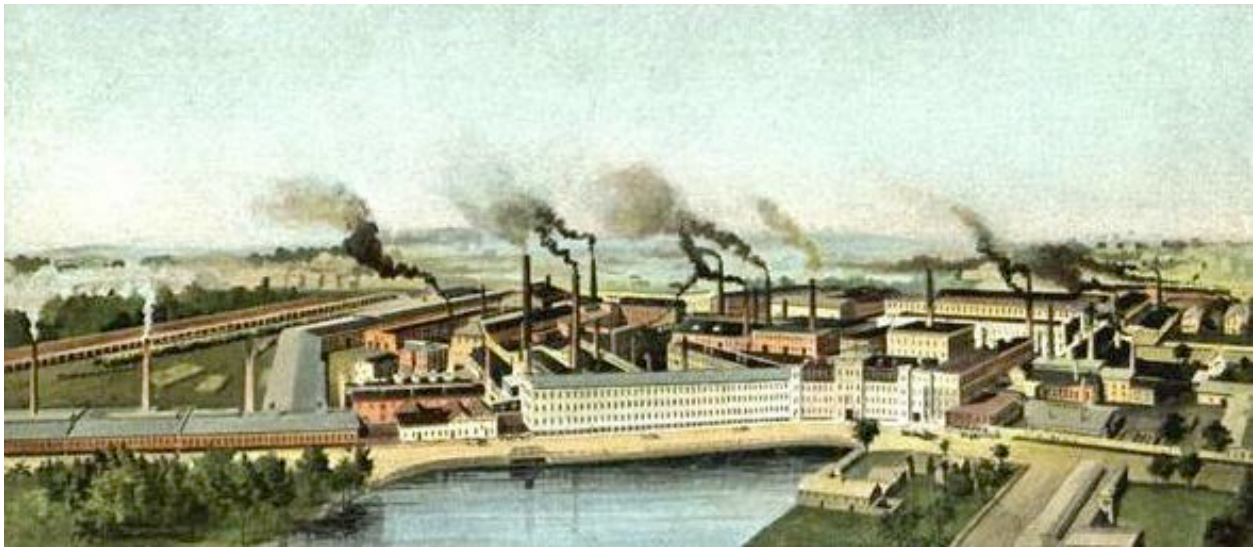


Figure 1: Example of Mills and Factories Located Along the Blackstone River

After this, Slater's success inspired many other entrepreneurs to build their own water-powered factories along the river as shown above in Figure 1. It was during this time, Chafee (2009) states, which the transformation from farm to factory was made and the area along the Blackstone became an economic and industrial powerhouse. With this growing industrial economy, the owners of the factories and mills began to see the river as an opportune place to dump all of their industrial waste and sewage. In an article by Kerr (1990), this is what started the pollution in the Blackstone River and eventually led the Environmental Protection Agency (EPA), to release a statement in the early 1990's saying that the Blackstone River is "the most polluted river in the country with respect to toxic sediments".

To this day the river water quality is still greatly affected by sewage discharge, combined sewer overflows, urban and agricultural runoff and pollutants leaching from active and abandoned landfills says Kerr.

Figure 2: Sediment Traveling off of Impervious Surface into Sewer During Rainfall

Stated by Williams (2011), storm water pollution is now the number one water quality problem in the U.S. and is the major source of pollution to Massachusetts's waters statewide. As shown in Figure 2, storm water pollution, or storm water runoff is when the storm water runs off impervious surfaces such as parking lots and driveways, drains into the combined sewer system and straight into local rivers and streams. This runoff carries many of the pollutants that are found in the river such as oils, pet waste, fertilizers and pesticides, bacteria, nutrients, and heavy metals. Not only does storm water runoff carry many pollutants into the river, but it also causes the combined sewer system to over flow. In the Water Pollution Prevention Program (2011), when the wastewater volume exceeds the capacity of the sewer system or treatment plant, cities are forced to dump the untreated waste directly into the river. The Upper Blackstone Water Pollution Abatement District (UBWPAD) in Worcester is the largest single source of pollution entering the river. As stated by the Upper Blackstone Water Pollution Abatement District (2011) themselves, "the UBWPAD is excellent at removing oxygen consuming materials from the wastewater, but not effective in treating the toxic waste." 77 to 96 percent of the heavy metals transported into the river come from the UBWPAD.

By providing the community with valuable information about the pollution in the river and the causes of it, we are placing some responsibility on them. Placing this responsibility on them forces the community to realize that what they do on a daily basis has a very large impact on the pollution. It will show them that their individual response can make a difference in bringing this problem one step closer to better.

2.2. Water pollution in Worcester

There are many things that factor into the condition of the Blackstone Valley River: one of them being the Combined Sewer System. Many states deal with the problems of a combined sewer system, but here in Massachusetts, particularly in Worcester it is a serious issue. The combined sewer system incorporates possible pollution from two main sources, sewage and storm water. Beyond the environmental consequences the river faces, the city of Worcester is held responsible for the CSO's and is fined for dumping high levels of toxic waste into the river.

2.2.1. Combined Sewer System

In the city of Worcester there is a combined sewer system that handles the process of allocating storm water runoff and sewage through underground pipes that redirect the water and waste to treatment plants and other outflow areas. A combined sewer system by definition by the EPA, is a sewer that is designed to collect rainwater runoff, domestic sewage, and industrial wastewater through the same pipe line and transports the wastewater to a sewage treatment plant. At The Upper Blackstone Water Pollution Abatement District, the contaminated water is treated and then discharged to a body of water, such as a lake, pond or river such as the Blackstone River. However, during times of heavy precipitation, like rain or the melting snow, the volume of wastewater can exceed what these water treatment plants normally handle. This forces the treatment plant to dump the raw sewage into the river. These overflows are referred to as

combined sewer overflows (CSO's) and are a problem that is very present in Worcester today. The EPA has recognized many of the toxic pollutants that are in the combined sewer over flows as industrial waste, toxic materials, and debris beyond just storm water.

The problem of combined sewer overflows has also caused problems in other areas around the country such as in the New York Harbor area. According to River Keeper, more than 27 billion gallons of raw sewage and polluted storm water discharge out of 460 CSO's into New York Harbor alone each year. Even though the problem has slowly become less of a burden for the community it still creates an unsafe environment. An example of this from River Keeper shows that immediately after it rains in the area it "can create an issue for tourism with beaches and certain locations of the Hudson River waterfront, and this pollution creates a great danger to health of animals, humans and the general water quality in the area"

The Massachusetts Department of Environment Protection (2011) shows that the City of Worcester maintains a "Municipal Separate Storm Sewer System", which deposits into the following waters: "Beaver brook, Blackstone river, Broad meadow Brook, Coal Mine Brook, Coes Pond, Curtis Pond, Fitzgerald Brook, Indian Lake, Kendrick Brook, Kettle Brook, Lake Quinsigamond, Leesville Pond, Middle River, Mill Brook Tributary, Tatnuck Brook, Patch Reservoir, Poor Farm Brook, Salisbury Pond, Smith Pond, Weasel Brook, and Williams Millpond." When there is a significant amount of water to the point where it exceeds normal capacity of the system, sewage will mix with the storm water and cause further contamination.

2.2.2. The Difference Between Sewage and Storm Water

Although both sewage and storm water can have a negative effect on the bodies of water in Massachusetts, there are distinct differences between what they are and how they negatively affect these bodies of water, particularly the Blackstone Valley River. The webpage Zap the

Blackstone (2011) states that “Storm water can be defined as rainwater that falls on an impervious surface such as cement or asphalt picks up pollution or sediments and runs off into the combined sewer system.” On the other hand, as defined by the EPA (2011), sewage can be defined, whether domestic or industrial, as waste that is produced and transported through the underground piping system. The effect that both storm water and sewage have on the Blackstone Valley River, or any other body of water for that matter, is that they both carry contaminants and pollutants that can cause an unsafe environment within the bodies of water they filter into. Storm water itself is not dangerous, but the oils, grease, and debris that is picks up as it makes it way to the storm drains can create a very harmful environment within the river. Sewage is harmful to the river because it is waste that contains bacteria and other dangerous toxins that can very quickly cause a change in the ecosystem of the Blackstone Valley River and create an unhealthy environment for the wildlife in the area.

2.2.3. Problems Caused by Pollution

There are many ramifications of the pollution in the river. It leads to poor water quality, an increase in flood levels and the frequency of flooding, and violations of the Clean Water Act that result in the city being fined. Figure 3, shown below, demonstrates on of the ramifications caused by the excess storm water runoff. In the water quality report done from 2003 to 2007 by the DEP (2011), the condition of the segment of the Blackstone River, which passes through Worcester, was very poor. The report stated that the aquatic life, primary contact, secondary contact and aesthetics were all impaired.

Figure 3: Example of flooding on fruit street

The sources that lead to the impairment of the water quality are caused by many of the pollutants being carried into the river from sewage discharge and storm water runoff. In a news report done by CBS (2006), the EPA has also fined the city of Worcester for violating the Clean Water Act to the tune of a $125,000 settlement for dumping their overflow into the river over 70 times in the past five years. “That means raw sewage has been dumped into local ponds and rivers — potentially exposing people to bacteria and industrial toxins.” The DEP (2010) states that the Clean Water Act was put into effect to help restore and maintain the chemical, physical, and biological integrity of the nation’s waters by preventing point and non-point solution sources. In other words, they put restrictions on discharging pollutants into bodies of water to help improve the water quality.

2.2.4. Pollutants in the Blackstone River

In an article written by Peter Coffin (2011), a member of the Blackstone River Coalition, he identified three major categories of pollutants. The categories he defined are: sediments contaminated by historic industrial toxins, nutrients from treatment plants and storm water runoff. Many of the pollutants from the industrial era that were dumped into the river centuries ago still sit dormant on the river floor. Short of dredging the river floor, these sediments rest at the bottom and can be stirred up when contact is made with the bottom. As previously stated, the Upper Blackstone Water Pollution Abatement District is the largest point source pollution entering the river. Several of the nutrients deposited into the river from the raw sewage dumped by the UBWPAD are very harmful to the aquatic life and overall water quality. Table 1 below shows some of the pollutants found in the river and their impact on the environment.

Pollutant	Impact
Phosphorus	Causes excess growth of bacteria such as E. Coli
Nitrogen	
Pet Waste	
Fertilizers	Causes excess algae to grow eating up all the oxygen in the water that would be otherwise used for the wildlife.
Pesticides	
Oils and Grease	Discharge from vehicles harms the plant and animal life living in and around the river
Heavy Metals such as Zinc, Cadmium, Copper, Chromium, and Lead.	Creates a negative effect on environment.

Table 1: Pollutants and their impact

The pollution that comes from treatment plants is known as point source pollution. Defined by the DEP (2011), point source pollution comes from a discrete source or single outlet such as a discharge pipe at an industrial plant or wastewater treatment plant. It is called point source because it is easy to pin point where the pollution is coming from. As well as the sewage discharge, storm water runoff is especially harmful because it does not pass through treatment plants; it is filtered directly into the river. The pollutants and sediments carried by storm water

runoff, found by the DEP (2011), consist of nutrients such as phosphorus and nitrogen, pet waste bringing in high levels of bacteria such as E. Coli, fertilizers and pesticides which cause excess algae to grow eating up all the oxygen in the water, oils and grease from things such as cars, and heavy metals such as zinc, cadmium, copper, chromium and lead. Opposite from point source pollution, the pollution coming from storm water runoff is called non-point source pollution because it is difficult to pin point and control, and occurs where ever there is human activity. Because of all this pollution as Kerr (1990) states in an article, in 1988, the State of Massachusetts released a statement to Congress saying that "all of the river was polluted and not suitable for bathing."

The contamination that exists in the Blackstone is a problem that could potentially take a significant period of time to handle. The problem with combined sewer overflow, non-point pollution, and sewage are problems that not only exist in Worcester but also in other states around the country. Once the sources of all these problems are known and acknowledged by our target audience, serious change can begin to take place and help make the Blackstone River a more hospitable and livable environment for animals and humans alike.

2.3. Advertising and Outreach Techniques

In this section we take a look at different concepts that should be considered when designing effective outreach. We mention the specific challenge that environmental campaigns must face and we briefly analyze basic advertising principles in relation to appropriate psychological theories. We conclude by examining the previously discussed concept in relation to our project.

We must first define outreach and its purpose in order to analyze the way in which it can help us accomplish the objectives of our project. As said by Loegering (2011), in general terms,

we can take outreach to be “high-quality public education that both addresses an informational need of a user group as well as produces benefits to all citizens of the state and the environment”. We can expand this by saying that education through outreach aims to recruit the efforts of others to achieve the benefits of a common cause. Firth (1998) states that science and decision-making should support each other for both of them to be most effective. It is the role of outreach to bridge this gap between knowledge and its use, and this is no easy task. One must try to express complex scientific issues in attractive and understandable terms says Hudson (2001) while also ensuring that the scientific process continues to fuel the understanding of the environment and the forming of solutions. Outreach efforts not only try to make the information reach the desired audience but must also ensure that the audience is able to absorb the information despite its potential complexity.

At the most basic level we can approach the problem through advertising techniques. Advertising, similarly to outreach efforts, aims to persuade an audience into taking a specific action. Three objectives highlighted by Soumerai and Avorn (1990) that always arise in this field are: specifying a target audience, having a clear message and having clear behavioral objectives. Specifying a target audience depends mainly on the goals of the project, and so it shall be discussed later within the context of our project. At this point, we will look at ways to improve the clarity and transmission of a given message through methods of cognitive psychology. Cognitive psychology says Clark (2011), relies on scientific methods for the transmission, understanding and retention of information. This includes techniques such as taking advantage of the audience’s pre-existing knowledge, ensuring coherence throughout a piece of text and using images in a certain manner to assist learning. It is worth noting that knowledge does not ensure behavioral change, says Whittingham, Ruiter, Castermans, Huiberts and Kok (2007), but

"knowledge is the central foundation of more proximal psychological determinants of precautionary motivation and self-protective action." For this reason we must employ other methods if we want to have a more formal approach to behavioral change.

The most challenging and critical objective in any outreach effort is initiating a clear behavioral change. This is the specific action that you would like your audience to take so that work may be done towards the benefit of your cause. As discussed by Hudson (2001), one of the first issues that this needs to address in the audience is the psychology of despair, which is a loss of hope for the future and a sense that we as individuals cannot make a difference. One of the suggestions to help the audience avoid this situation is to end the message of your campaign with signs of hope and gratification. Additionally, there are other methods that might also be employed. On a similar approach, Morris, Jacobson, and Flamm (2006), suggest to make people care about your cause by giving them a sense of ownership and personal responsibility. A more formal approach are the theories of self-efficacy, which state that people's expectations of their own abilities influence how much effort they will put into something. This has a great impact on behavioral change because says Linde, Rothman, Baldwin and Jeffery (2006), "it is performance-based procedures that are proving to be most powerful for affecting psychological changes." This also means that successful performance helps create a positive outlook and increases the willingness to enact changes in behavior. Here we start seeing how all these theories start suggesting a methodology for our project.

The design of outreach encompasses many different areas of study and application. We have stated that outreach must ensure a close relationship between knowledge and its uses, which we must achieve in our project by informing our audience about the effectiveness of rain gardens in addressing sewage overflow issues. We have looked at cognitive psychology as an aid in the

transmission of information, which we must consider when designing the content of our promotional material. We have also presented the challenge of initiating a behavioral change and the theories of self-efficacy, which suggest that we must ensure that our audience has enough self-confidence in their abilities to effectively address the sewage overflow and water quality problems in the city of Worcester and the Blackstone River watershed.

2.4. Dissemination of Information

In order to inspire change, using outreach, the study of effective of social media campaign characteristics is very important. There are certain characteristics of effective social media campaigns that need to be considered. They should provide value in both physical and mental forms. They also need to be able to be measured, so creators can track the social media marketing efforts with building relationships of targets. To gain attention, they should be innovative, so people will pay attention to the materials. Lastly, using pictures, videos, and other graphics can call action from target. Boame (2011), states that an effective social media campaign requires using the right networks to contact and provide proper information to people. Not only understanding the characteristics of a campaign that can help improve the social media campaign, but great planning and processing also help produce effective social media campaigns.

There are steps that can help the work flow of social media projects. Firstly, overall communication strategies, such as the subject, target, and goal, need to be definite. Other factors that must also be definite include the, topics, detail, and visual communication, such as images, videos, animation. Text needs to be carefully written. Try to put all as a first version. Then, this first version should go to quality check in order to revise. With doing this might require interview and survey. Finally, the final of media product can me created. With follow these steps; the creation of social media and outreach can reach target people effectively.

2.5. Rain Gardens as a Viable Alternative

Rain gardens are a way to help alleviate the problem with storm water runoff. Storm water runoff, as well as other environmental issues, is usually handled by some form of gray or urban infrastructure.

Figure 4: Example rain garden in Leominster, Massachusetts

As demonstrated in figure 4 above, one characteristic of rain gardens is that they are an example of green infrastructure that complements the existing urban infrastructure in the area. Specifically for the area of Worcester and Central Massachusetts, rain gardens are an example of green infrastructure the complement the existing storm water management system.

2.5.1. Gray Infrastructure

In this day and age there are many cities that are predominantly dependent on gray infrastructure. Gray infrastructure, or built infrastructure like roads, buildings or utility lines

states McMahon, are substructures created that the community depends on for continuance or growth (pg. 8). There are many examples of gray or unban infrastructure, for instance roads, sidewalks, buildings and sewer system. The combination of the various influences driving infrastructure construction is clearly illustrated with consideration to three areas of importance, streets, water supply and sewers says Hanson (pg. 11). This source of information is adapted literature that explains the perspective of urban infrastructure during the nineteenth and twentieth century. Worcester is a city that was established in 1713, meaning that during the period of time leading from its founding until present day, Worcester experienced a boom in a gray infrastructure development. The purposes of our project are directly affected by the characteristics of the streets and the sewers.

The reason why many urban environments are dependent on gray infrastructure is because of its many benefits. Gray infrastructure exists in homes, in the form of indoor plumbing, the systems of power and heat as well as the structural integrity of homes themselves. As stated by Houghwout (2001), in Infrastructure and social welfare in metropolitan America, the quality of life benefits of urban investments are important because households are heavy users of infrastructure systems. This capitalizes on the ideology that gray infrastructure is not only heavily used as a necessity but as a way of making life more convenient. This convenience is what has caused many to become reliant on gray infrastructure, and in effect created an expectation for gray infrastructure to be the only or best solution for a project or issue at hand.

Figure 5: Upper Blackstone Water Abatement District, Water Treatment Facility

Worcester is a city that has examples of gray infrastructure integrated into the city of Worcester has many examples of gray infrastructure. Specifically for this project gray infrastructure that requires the most focus is the combined sewer system. One of the principal reasons for creating gray infrastructure is that it reduces many of the negative effects of urban life, furthermore allowing cites to grow and increase productive and consumption advantages they offer. Furthermore, Houghwout (2001) says, in theory public systems draw to cites from places where it is excessive and wastewater treatment plants and public land fills to help process the city's waste. The sewer systems as well as other gray infrastructure systems in Worcester were created with the purpose of making urban life easier, but this excerpt also holds true for Worcester in that water from other locations in the watershed go through and are connected to Worcester.

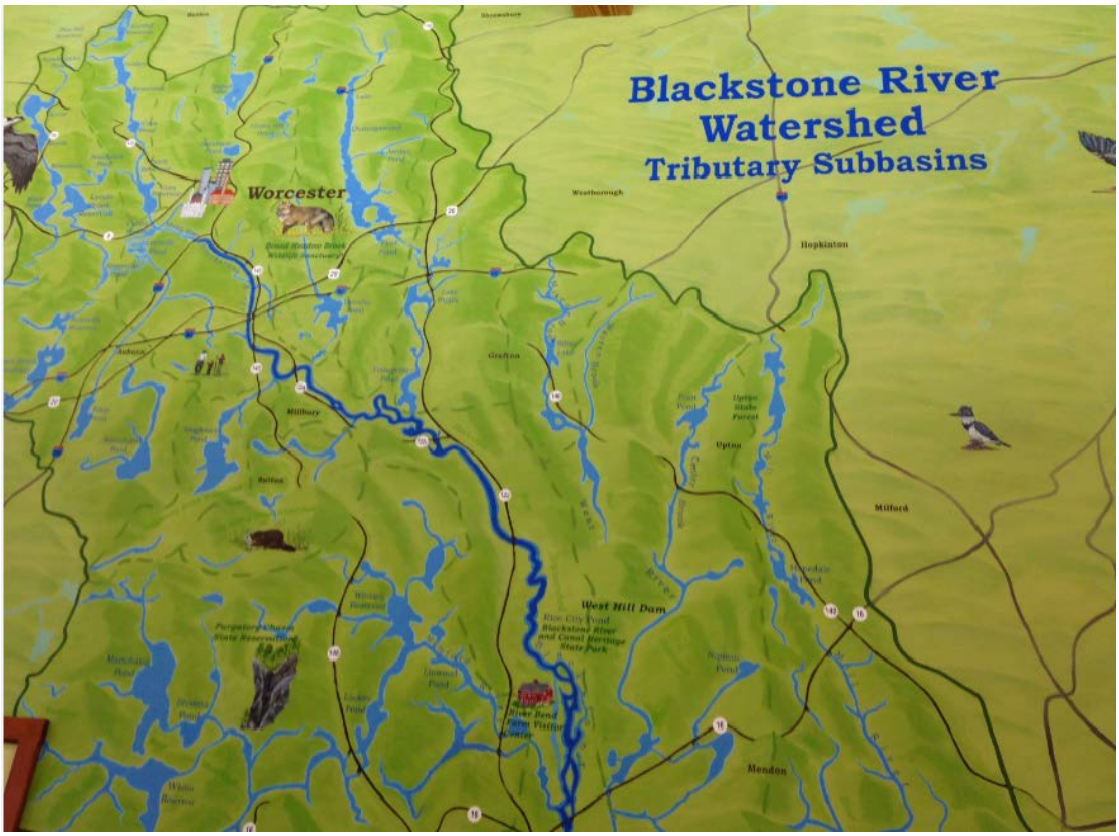


Figure 6: Picture of the Blackstone River watershed, Broad Meadow Brook

Because of the demand of water processing and purification that Worcester has to handle many times the combined sewer systems are overwhelmed. This can create an issue when it comes to purifying water because the treatment plant doesn't have the resources to clean all of the water and is forced to dump into the Blackstone River.

Figure 7: Upper Blackstone Water Pollution Abatement District

The sewage treatment plant in figure 7, The Upper Blackstone Valley Water Abatement District, is an example of gray infrastructure that works with the combined sewer system. It receives the sewage and the storm water and works to process and purify it.

This gray infrastructure is often overwhelmed by the amount of water it needs to purify and is often fined for the consequences of it not being able to handle it. There are many solutions that exist that the city has considered that would require a lot of money that are also examples of gray infrastructure. They include creating another treatment plant, or working on the sewer system so that it handles the combination of storm water and the sewage more effectively. Although these techniques for handling the issues of storm water runoff, flooding and pollution are effective there are alternatives. Green infrastructure is an example of an alternative to urban infrastructure, and is a method we hope to promote through the completion of our project.

2.5.2. Green Infrastructure

Although the city of Worcester is a city that is dependent on the benefits of gray infrastructure, there are alternatives to help aid with daily processes and the issues that can occur through green infrastructure. As defined by Amundsen, Allen, and Hoellen (2009), green infrastructure can be understood as a structure set apart to aid a local problem, or emergency that effectively utilizes environmental resources sustainably. Contrary to popular belief green infrastructure's primary purpose is not to act as a replacement to gray infrastructure but to act as a complement. Although there are situations where green alternatives would make more sense, for the most part, they are meant to aid the currently existing gray infrastructure in hopes of lessening the financial strain of creating additional gray infrastructure. As mentioned by McMahon in the journal/article green infrastructure, roads and other forms of gray infrastructure upon which America's communities depend provide a framework for future growth and

development, while green infrastructure is made as a frame work for conservation, where communities can plan to protect green spaces. This is an example of the perspective green infrastructure has in the way it complements gray infrastructure. Gray infrastructure is utilized for the expansion of society through growth and development, while the complements by conserving and sustaining the surrounding environment. Examples of green infrastructure complementing gray infrastructure are in Montgomery County Maryland.

In Montgomery County, Maryland, McMahon (2001) shows an example of green infrastructure that was implemented with the purpose of protecting green infrastructure before development. This example of green infrastructure implementation is unique because it utilized planning. Montgomery County planned green infrastructure in advance to the county's growth. It bought land along the major stream corridors in the mid 1900's before the rapid land development due to population growth made it unfeasible to do so claims McMahon. Furthermore, because of this early planning, this county was able to protect farmland, stream valley parks, ecological reserves, trail corridors, and green space preserves says McMahon.

The protection of these green locations due to planning is an example of green infrastructure complementing gray infrastructure. The green infrastructure complemented the development of gray by planning for its expansion and sustainably allowing growth in that particular area for the sake of its natural resources. This community planned for possibility urban growth and identified critical ecological sites that need to be protected to sustain the growth. Another example of green infrastructure complementing gray is in Minnesota.

Figure 8: Picture of the Blackstone River

In the Twin Cities Region in Minnesota, McMahon shows there was an example of green infrastructure complimenting gray through a program they created called the Metro Greenways Program (pg. 22). This program's primary purpose was for the creation of programs for resource conservation and restoration. This program opposite to the example above, worked with the remaining environmental resources for the implementation of green infrastructure after ninety six percent of the available land resources were already utilized by urban infrastructure says McMahon (pg. 22). It worked by complimenting the existing gray infrastructure for the sustaining of the remaining natural resources in the area. Conservation development is also an example of green infrastructure complementing gray infrastructure.

Figure 9: Picture of a canal of the Blackstone River

In Grayslake, Illinois there is an implemented example of green infrastructure in the form of conservation development. This example of green infrastructure has the purpose of restoring and protecting environmental resources claims McMahon (pg. 22). This example of green infrastructure compliments and adds value to residential development. He also says the green infrastructure protects the open space where there are environmental resources, such as active farmland, wetlands, lakes, ponds and recreational parks (pg. 22). By protecting these resources the green infrastructure in the form of preservation is able to complement the gray infrastructure by adding value to it. Another example of green infrastructure complementing gray infrastructure is through Green infrastructure to reduce Storm water management costs.

Figure 11: Gutter dumping excess water in flooding area

In Topeka, Kansas there is an implemented example of green infrastructure with the purpose of reducing Storm water management cost. The reduced costs occur through the green infrastructure enhancing the livability of the community with open spaces that work water quality and people throughout the watershed (McMahon, p 25). This city was suffering from serious storm water issues. In Topeka one inch of rain over the city equates to 940million gallons of storm water (McMahon, p. 25). This community decided to get in touch with local governments, state agencies and nonprofit organizations to address water quality concerns about the storm water runoff relating to water quantity and quality concerns **(**McMahon, p. 25). Furthermore, they decide to compliment the current available gray infrastructure with the vegetated swales, which are constructed wetlands, as well as other practices to contain and treat storm water. Although additional gray infrastructure, in the form of underground pipes and expensive concrete channels, were considered they realized that implementing green

infrastructure would we a more feasible solution financially as far handling the issue. This example of Green infrastructure is similar to the purpose of our project. The aim of our project is to motivate the use of rain gardens. We aim to portray through the form of our outreach material that rain gardens are a form of green infrastructure that can complement the existing gray infrastructure in the city of Worcester. We also hope to show how they are financially more feasible then the building of additional form of gray infrastructure. Rain gardens are an alleviate to the storm water issues, in the form of pollution and flooding, that Worcester suffers from, as well as its abilities to sustain the natural resources in Worcester the form of land and local waters ways like the Blackstone River.

2.5.3. Function, Design and Benefits of Rain Gardens

Rain gardens are a great example of green infrastructure in the way it can complement the gray infrastructure of the sewer systems and storm water management. Rain gardens are landscaped areas incorporated with wild flowers and other native plants that absorb rain water from roofs of houses or other impervious surfaces (Rain Garden Manual, Blackstone Water Coalition). Rain gardens fill up with inches of storm water and gradually filter it into the ground instead of allowing it to runoff into local sidewalks, streets, and storm **(**Rain Garden Manual, Blackstone Water Coalition). Rain gardens are different from the average form of landscaping in that rain gardens allow about thirty percent more water to soak into the ground

Figure 12: Example of residential rain garden

Rain gardens are important because as cities and suburbs grow, areas of vegetation are replaced with impervious surfaces such as streets and parking lots. As impervious surfaces increase, the amount of storm water that runs off into local streets and storm drains increases. This causes flooding that carries pollutants and chemicals from streets, parking lots, and lawns into local water ways like lakes and streams. Furthermore, this leads to costly urban improvements in storm water treatment structures (Rain Gardens Manual, Blackstone Stormwater Coalition).

Rain gardens are a simple method that everyone can make in order to provide cleaner storm water runoff into the rivers and fewer sewage overflows. Rain gardens are an environmental benefit to the community in a number of different ways. They increase the amount of water that filters into the ground, which in turn recharges local and regional aquifers.

(Rain Garden Manual, Blackstone Stormwater Coalition p.2) Rain gardens also help protect communities from flooding and drainage problems and help protect local water ways like streams and lakes from pollutants carried by urban storm water. Rain gardens are one of many ways to reduce pollutants carried into rivers by storm water runoff because it absorbs the runoff along with its pollutants and absorbs it into the ground. Scott LaFleur (2008), a Horticulture & Botanic Garden Director of New England Wild Flower Society defined that "Rain garden is designed to capture water from impervious surfaces such as roofs, driveways, walks, and patios. Rain gardens are depressions built into the landscape and planted with native plants. They allow water to pool during and after a storm. The storm water then slowly filters into the ground, undergoing a natural microbial process that results in cleaner water," (2008). This explains that rain gardens can filter storm water by native plants roots and microorganisms that help absorb the water. Education for Municipal Officials (NEMO), University of Connecticut found out that "Overall, concentrations of nitrite+, nitrate-N, ammonia-N, and total-N (TN) in roof runoff were reduced significantly by the rain gardens, (2006). As shown in figure 1 this research supports that microorganisms can improve the quality of storm water before it runs into local bodies of water.

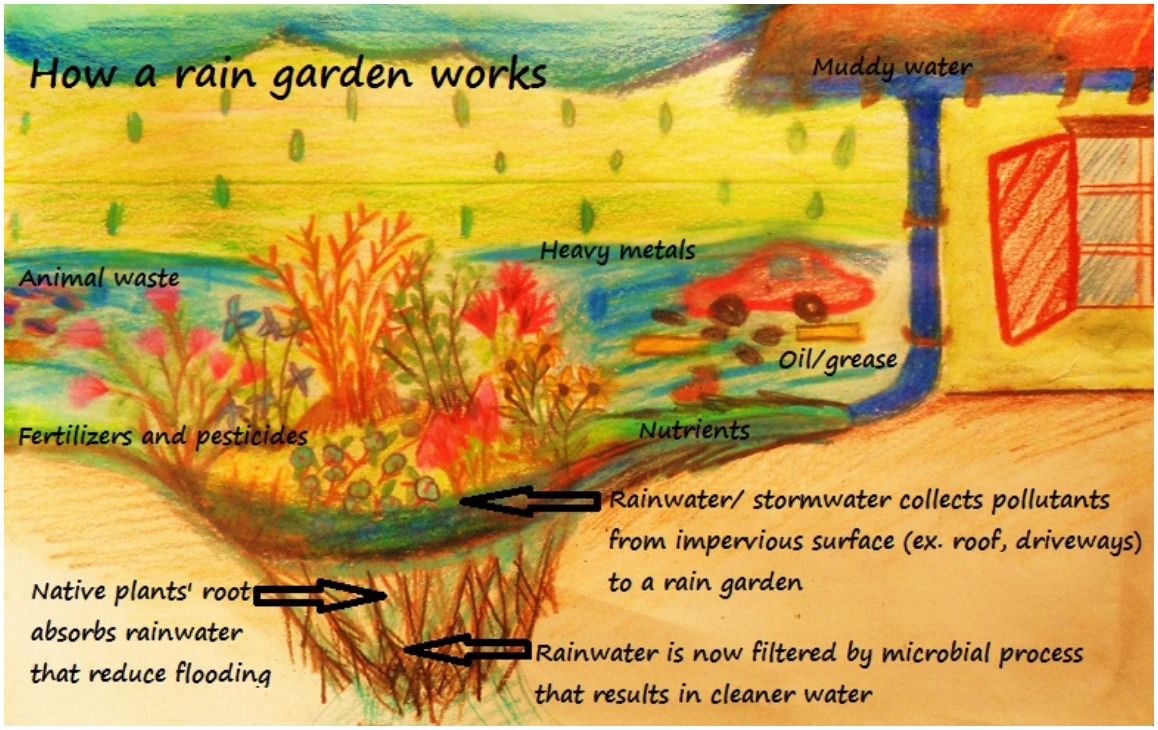


Figure 13: Diagram of how a rain garden works

Low Impact Development Center (2005) also explained that rain gardens are designed to withstand moisture and high concentrations of nutrients especially Nitrogen and Phosphorus that are found. After the water is filtered into the ground, microorganisms in the soil will help to reduce nitrogen, phosphorus, and other sediments (2005). In research by Michaele E. Dietz and John Clausen from Nonpoint Education for Municipal Officials (NEMO), University of Connecticut found out that "Overall, concentrations of nitrite+, nitrate-N, ammonia-N, and total-N (TN) in roof runoff were reduced significantly by the rain gardens, (2006). As shown in figure 1 this research supports that microorganisms can improve the quality of storm water before it runs into local bodies of water.

The Low Impact Development Center (2005), defined two basic types of rain gardens: under-drained and self-contained. These two basic types are both dependent on a volume of water, soil condition, and space. The under-drained rain gardens are mainly used to absorb small

amounts of water. This type of rain garden can be drained approximately 4 hours after 1-inch rain is accumulated. The under-drained rain gardens usually transfer excess water into water pipe systems. On the other hand, self-contained rain gardens allow more water volume to stay over a longer time period. Thus, the second rain garden type requires native plants that can tolerate more on inundation of water in extended periods of time. In addition, there are also other ways to define types of rain gardens, such as shape, and location as described by The Virginia Department of Forestry (2011). An example of this would be, a small rain garden that absorbs rain water from small impervious area for houses, and a large, long rain garden that drains runoff from walkways. Table 2 shows the difference between both types of rain gardens.

Types of rain garden	
Under-drained	Self-contaned
- used to absorb small amounts of water - drained approximately 4 hours after 1-inch rain is accumulated	- Allow more water volume to stay over a longer time period
- usually transfer excess water into water pipe systems	- requires native plants that can tolerate more on inundation of water in extended periods of time

Table 2: The difference between under-drained and self-contained rain gardens

Both types of rain gardens can be made with a simple process. As demonstrated in Figure 14 and Table 3 below, to make a rain garden, the size of the garden should be about 30 – 50 % of the size of the impervious drainage area, such as your roof, walkways, and driveways. After that, an appropriate location should be determined and prepared. Most importantly, you must determine the channel of water, so the rain garden can catch the runoff water from the impervious drainage area and absorb it. Soil composition must also be considered. The soil should be composed of50-60% sand, 20-30% topsoil, and 20-30% compost. To keep the soil

moist and ready to soak up rain water, a mulch of shredded hard wood is also added. Finally, you must select native plants according to the sunlight level of the garden. LaFleur (2008) explains that rain gardens use native plants because it needs to be able to tolerate inundations of water and dryness periods. More specifically, dry tolerance native plants are grown on the edge where is

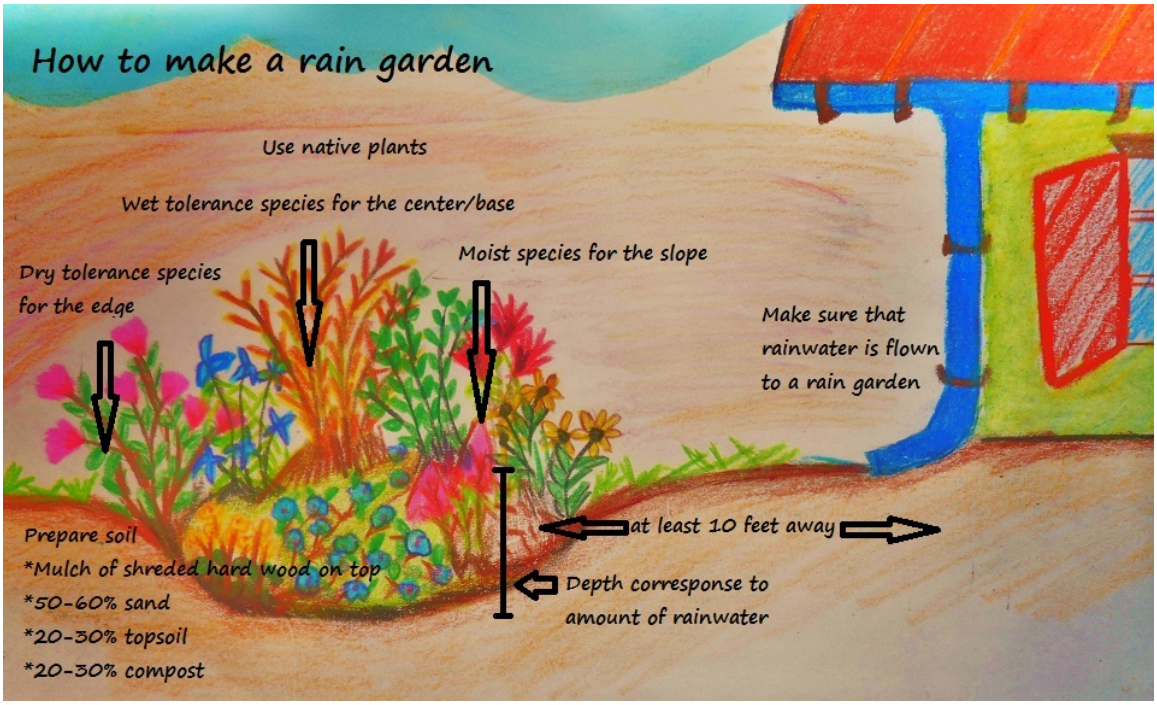


Figure 14: Diagram of how to make a rain garden

mostly dry while wet tolerance native plants are usually located in the base or center of the garden where most of the water is collected and pooled until it is absorbed. In New England alone, there is a collection of rain garden native plants, especially Worcester by RUTGERS, New Jersey Agricultural Experiment station.

1. Size	Should be about 20 – 30 % of the size of the impervious drainage area, such as your roof, walkways, or driveways. - Ex. If your rain garden is going to drain water from 200 square feet roof, it needs to be at least 40 square feet.
2. Location	At least 10 feet away from building foundations and septic systems.
3. Soil	50-60% sand, 20-30% topsoil, and 20-30% compost
4. Mulch	(A mulch of shredded hard wood that doesn't float) keeps the soil moist and ready to soak up rain
5. Plants	Use native plants that tolerate for dry condition on the edge and wet condition on in the center. For the slope, use moist native plants species

Table 3: How to make a rain garden

Many organizations and societies are willing to provide information and resources to help support people focusing on environmental issues including storm water runoff and the creation of rain gardens. For example, the New England Wild Flower Society provides general information on rain gardens including some useful techniques to maintain the gardens. Rain gardens can be built by everyone because the process is simple, and it is very helpful to the environment. Table 3 and figure 14 represent how to make a rain garden.

2.5.4. Cost and Concerns with Rain Gardens

Rain gardens can be built and maintained easily. Some concerns people have about making rain gardens are things such as cost, the attraction of mosquitoes and how the change in season might affect the plants. On average making a rain garden is not expensive. The cost of residential rain gardens is approximately $ 3 - $ 4 per square foot while the institutional costs are around $ 10 – $ 40 per square foot. However, it is also dependent on the plants and the soil condition. Table 4 below shows the approximate cost of making a rain garden.

Options	Cost ($/square foot)
Buy the plants and build it yourself	3 - 5
Hire a landscaper	10 - 12

Table 4: Cost of making a rain garden

People also have concerns about whether the garden will attract mosquitoes because of the water retainment. The Virginia Department of Forestry (2011) explained that mosquitoes cannot grow by using the drained water in the rain gardens. Since mosquitoes normally need a week to grow in the water and rain gardens usually drain 24 – 48 hours, mosquitoes cannot survive, therefore, they should not be a concern. Lastly, people are usually concerned by how the winter might affect the gardens. Basically, the native plants used in rain gardens can adapt and survive in winter. So if the right plants are chosen there should not be a problem. Recently, in a study done by Muthanna and his team, they examine the efficiency of rain gardens during all four seasons throughout the year. By measuring the hydraulic detention time that tells the quality of soluble compound in the soil and plant, he found out they were not significantly different throughout the seasons. Also, in order to improve infiltration of rain gardens during the winter, more sand should be added into the soil composition (2008). However, Chris Emery (2006) pointed that "many people are skeptical of new ideas and do not want to put something in place until they find out it definitely works." This explains that to improve the knowledge of rain gardens, all of people's concerns need to be addressed, and all the benefits need to be described.

Some people might not understand the benefits in reducing pollutants from the storm water runoff and the simple process of making rain gardens, so they still have a negative view of rain gardens. However, the benefits and process of making rain gardens should be easily

understandable and strong enough to be able to persuade people to realize the effect of rain gardens. If people know and understand the problem surrounding pollution in the river and how rain gardens are great solution to help reduce this pollution, they would be more motivated to make their own.

Chapter Three: Method to Develop Media and Dissemination of Information

Understanding the difference of each media and how they support each other, along with the demographic and background of our target audience, media themes, and models that we can follow to create effective media, helps us disseminate information to the target audiences in order to accomplish our project's goals. In this project, we developed a brochure, a video, and a website. So, we needed to understand their strengths and limitations including how they can work together to enhance strengths and reduce weaknesses. We identified media's messages or themes. The messages of media were based on the problem situation and target audiences' background knowledge on the problem of sewage overflow in Worcester and rain garden. We collected and analyzed this data by making phone call interviews. Finally, we adapted the DGAR model, determine, generate, analyze, and revise, that we followed to create each medium. This chapter is going to cover how we researched on media and target audiences' demographic and knowledge background, defined media message, and adapted the DGAR model.

3.1 Multiple forms of media

Combining different forms of media with different strengths and limitations can enhance the ability to disseminate information. Studying media and the difference of media can help us understand each medium and how they support each other. Kozma (1991) highlighted in his paper, Learning with Media, that factors that affect the efficacy of media include the delivery of information by a visual means, verbal means, written means, or some combination of these modes. The point of these topics has the means to influence the audience's cognitive engagement to the idea or information. The different types of media have strengths and weaknesses based on

how they deliver information to the reader or viewer. Also, each medium uses different forms of dissemination strategies that make them have different limitation in spreading the information to the audiences. In this project, we developed brochure, video, and website, which would promote and educate rain garden as a solution to help alleviate sewage overflow and water pollution in Worcester. In order to accomplish the goal, we needed to study the strengths and limitations of each medium, brochure, video, and website, and understand how they are related and able to collaborate with each other in order to spread out the information to our target audiences.

Brochure or other kinds of printed medium have higher ability to access to express tactile and visual aspect to the community than video or website media. Hannafin and Hughes (1986) discovered that brochure can provide a series of main idea of information. Also, brochure has strength that it is able to access effectively when people need information in short time. It is also can spread information without high technological requirements. Johan Fornas and his writers' team (2007) wrote in the Consuming Media book that factors that limit the access of media are electricity, network, coverage, etc (p. 147). Website and video require more technical aspects. Video or CD require hardware in order to access, which increases the space between producer and customer (p. 68). This affects the idea of access and distribution of information provided by the media. In addition, brochure can be held by the reader. Thus, the reader can touch and examine the brochure. This shows that brochure has tactile and visual aspect. However, printed media, such as brochure, still has some limitations. They cannot be read in the dark time. Moreover, the quality of paper that is used in brochure might limit accessible target audience (p.148).These are only some factor that affect brochure's ability as a medium. Since, most of the time, brochure can access the community compare to video and website, we considered to create

the brochure. Brochures can access the communities most with less technological aspects requirements.

Video has a high ability to engage viewers. Frost and Marx (1998) explained that brochure or print media can provide basic to moderate levels of comprehension on target audiences, but videos can provide cognitive engagement. Video is able to maintain the audiences' interest. According to our observations, people tend to like to watch thing in a commercial rather than read a commercial brochure or poster. We believe that by watching the actual situation of flooding and water pollution problem in Worcester, the target audiences can realize and understand the problem. Video analysts Kaufman and Mohan (2009) also pointed out that the audiences tend to accept to visual than the traditional text based media. This state is corresponds to the idea of Johan Fornas and his writers team (2007) that explain how video can capture audiences most of the time (p. 101). Therefore, strength on maintaining peoples' attention, video is one of the best media to show the problem of sewage overflow in Worcester

Website's or weblog's provide high interaction between creators and customers or viewer. Brochure and video can provide only one way communication which means only text or motion of image that control the information and relation to the viewer. Donald Matheson (2005) stated that interactive media, such as website or weblog with using the internet, has contrast from the old media, such as broadcast and printed media, that it allow relationship between producer and customer (p.159). Viewers or customers can access in different times as much as they want to adjust information and participate in the activities of the website. For example, in the news website, customer can become a news reporter by sharing their news photo or experience. Other website might have some competition, so customer can come and join the activity in the website. By updating information and activities, viewer can participate and pay attention more in the

website. In addition, website can provide most complete information among brochure and video media. If the target audiences need completion of information, website should be the best medium here. Website can also link to other resources that help our target audience to support the audience if they have questions. Website has more complete information and provides an interaction between creator and viewers, so it enhances ability of dissemination of information.

3.1.1 The Advantages of Using Multiple Forms of Media

To strengthen the promotion of rain gardens, multi-media were used: brochure, video and website. Robert D. Marx and Peter J. Frost (1998) pointed out in their paper, toward optimal use of video in management education: examining the evidence, that the proper groups of multi forms of media can motivate audiences more. The paper explained that complete multimedia can support each other in order to provide motivation on people. We developed brochure in this project because the team wanted brochure to grab more members of target audiences' attention. It was said by Kim Golombisky and Rebacca Hagen (2010) that brochure is acts like a tour guide that welcomes visitors and leads them to the point that you want them to know (p.70). In order to guide audience to engage in the rain garden campaign, we created the brochure. Marx and Frost (1998) also gave opinion on video that affect learn and motivation on audience especially college students. Therefore, brochure and video can work together to grab people's attention. Website is also the best way that can provide complete information and access to more target audiences. Therefore, we decided to produce brochure and video that emphasizes our target audiences on water pollution, flooding problem in Worcester, and rain garden, as a simple and cost effective way to solve the problem. In addition, since website can help interaction with the viewer or target audience, website can help to keep in touch to our audience with updating information of rain garden campaign.

Brochure, video and website have different strengths and limitations, but they can work together in order create motivation on the target audiences. Only the brochure might be weak to engage people to understand the problem situation while video can engage more. However, they both lack space to provide complete information and limit interaction of communication to the audiences. Therefore, we created the website. A properly composed multi-media approach combines the strengths of each different type of media and minimizes the weaknesses. In this project, brochure and video have collaborated works on each other in order to promote rain garden by grab the target audience as a first place. After that, website would cover more complete information that is needed for rain garden which including problem situations in Worcester. Each medium have different strengths and limitations that make them support and collaborate on each other, so we created brochure, video, and website in this campaign.

3.2. Media Messages/Themes

Messages or themes of media were figured out the problem situation and target audiences' knowledge background. With researching and discussing with the sponsor and Blackstone River Coalition, we understood the problem situation. This also helped us to determine our target audiences. Then, we conducted the interview with them to understand their background on sewage overflow problem and rain garden. This section is going to cover how we determined the message for this project.

3.2.1 Discussion with the Sponsor and Blackstone water Researchers

By conducting interviews, we realized that people do not care much about water pollution and flooding problems, and that does not make them think of building rain gardens. In order to clarify the problem statement and rain garden of this project, the team members discussed with our sponsor, Isabel Gonzalez-Webster, who is the Chief of Staff, office of the Worcester Mayor,

who is responsibility to our project. In the meeting, the team also discussed with the other people who work dealing with Blackstone water researches: Donna Williams, Lance McKee, Peter Coffin, and Gerald Powers. According to the meeting, we realized that problem on water pollution due to rain water carried pollutant to the Blackstone River and sewer water is the harmful problem that needs help from Worcester communities. In this meeting, rain garden is introduced to us as a way to solve these problems. Since rain garden can be built and maintain simply, it is a great information that is needed to introduce to Worcester. Table 5 demonstrated the message that we discussed with our sponsor that can be applied to media messages.

Discussed message from the meeting	Our relevant ideas
It's so hard to work on providing rain garden since people don't even care their environment	If people understand that water pollution and flooding really affect their lives, people might care more on rain gardens
They are doing researches on the efficient of pollutant filtration of rain gardens	Their results can support and be emphasize in our outreach
Existing materials that they can provided us	They can be synthesized and improved.
Green Island (beyond Shrewsbury Street) has been dealing with bad flooding	This could be our target audiences because people who has problem should be interested in rain gardens more.
Broad Meadow Brook watershed neighborhoods have flooding problem	This could be our target audiences because people who has problem should be interested in rain gardens more.
Grafton Hill neighborhood association is having problem on flooding concerns	This could be our target audiences because people who has problem should be interested in rain gardens more.
Studies about rain gardens and their needs are located in a database created by students at Clark University and Worcester State University	This provided us database that can be contact for spread our outreach, and they could be our target since they have known on rain gardens before
Nurseries and Garden clubs	Nurseries can provide us discounts on plants for rain gardens that can support our project

Table 5: Message from meetings and outreach development

According to table 5 shown above, we realized that people do not care much about water pollution and flooding problems that make them. With the information in the meeting, we understood the flooding and water pollution problem and rain garden. Existing material and contact lists of Worcester homeowner who can be our target audience for this project were provided by Blackstone River Coalition. Donna Williams, a Watershed Advocate Blackstone River Coalition, provided us some material, such as brochures, posters, campaign, and training workshop on rain garden's file. Since her work is mainly about rain garden, she understands the problem and rain garden situation in Worcester. Donna also gave us with the contact information from the inventories that she had been working with in the past few months. Since they already listened to rain garden once, they might want to know more by joining our campaign. We needed to make them understand that rain garden is an easy and cost effective way that they can do to solve flooding and water pollution problem in Worcester. They should want to make their own rain garden. Table 5 shows important message that we discussed with our sponsor and the other Blackstone water researchers. These messages provided some idea of messages that should be provided by our outreach: brochure, video, and website.

3.2.2. Target audience determinant

The information used to create the graphs and charts concerning the demographic of our target audience throughout this chapter are adapted from Movoto. The Members of our target audience were determined based on a specific criterion. The goal of our project is to effectively motivate members of our target audience concerning the problems of storm water management. Members of our target were first determined with the two principles in mind, whether the people had the resources to plant a rain garden, and the second whether they were motivated or willing

to plant one. With these two principles in mind we advised by stakeholders to contact neighborhood associations, nurseries, and local environmental organizations.

3.2.2.1. Demographic and Target audience

The promotional materials for our project will have the most impact through the Caucasian Race. Based on the demographic information from the race that populates Worcester the most are Caucasians.

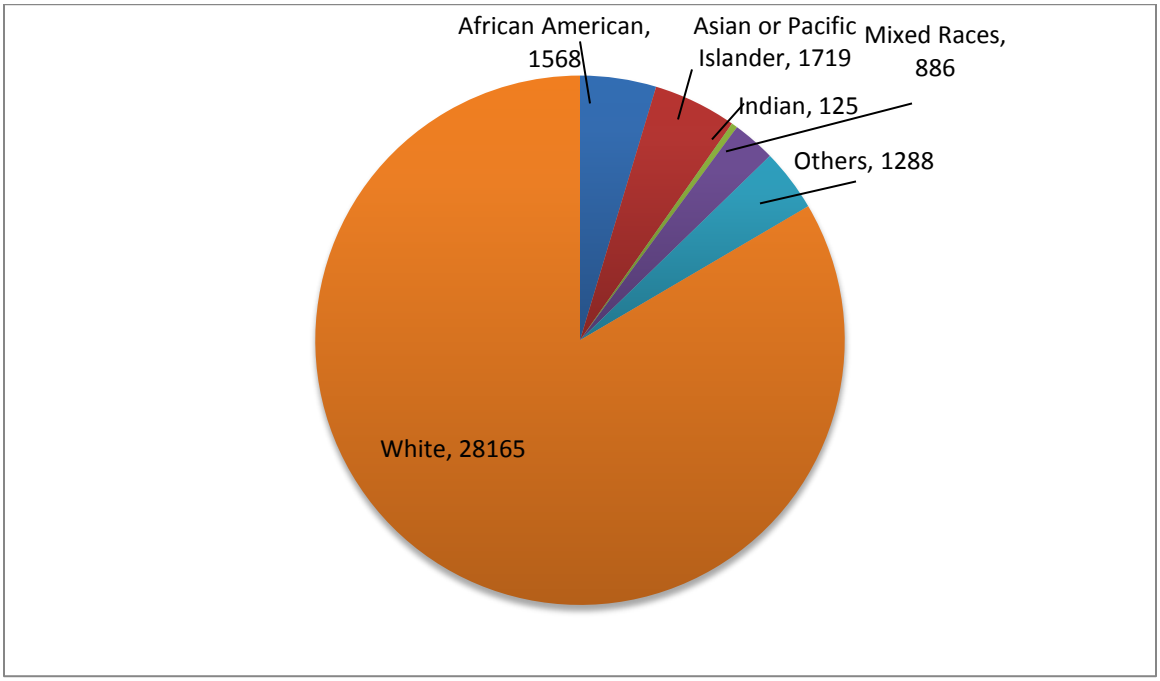


Figure 15: General demographic of Worcester city population; Population by Race

This means that our outreach, based on numbers alone will have the most impact and effect on this group. Although this fact was taken into consideration when designing our outreach material we made designs that were race neutral, because we aimed to get the attention of all respective races that are incorporated in the city of Worcester. We want to motivate the efforts of all the homeowners in Worcester, and based on the data from our sources, there is great likelihood of that homeowner being Caucasian. With this information in mind, it brought attention to possible

language choices for the creation of our outreach material. If the dominant race for this demographic of people were Hispanic or native Spanish speakers, we would have made an aim to design outreach materials in Spanish. With the population being predominantly white, we made a choice to design our outreach material in English realizing that we wouldn't have had a significantly different response to our outreach if we had initially designed them in multiple languages.

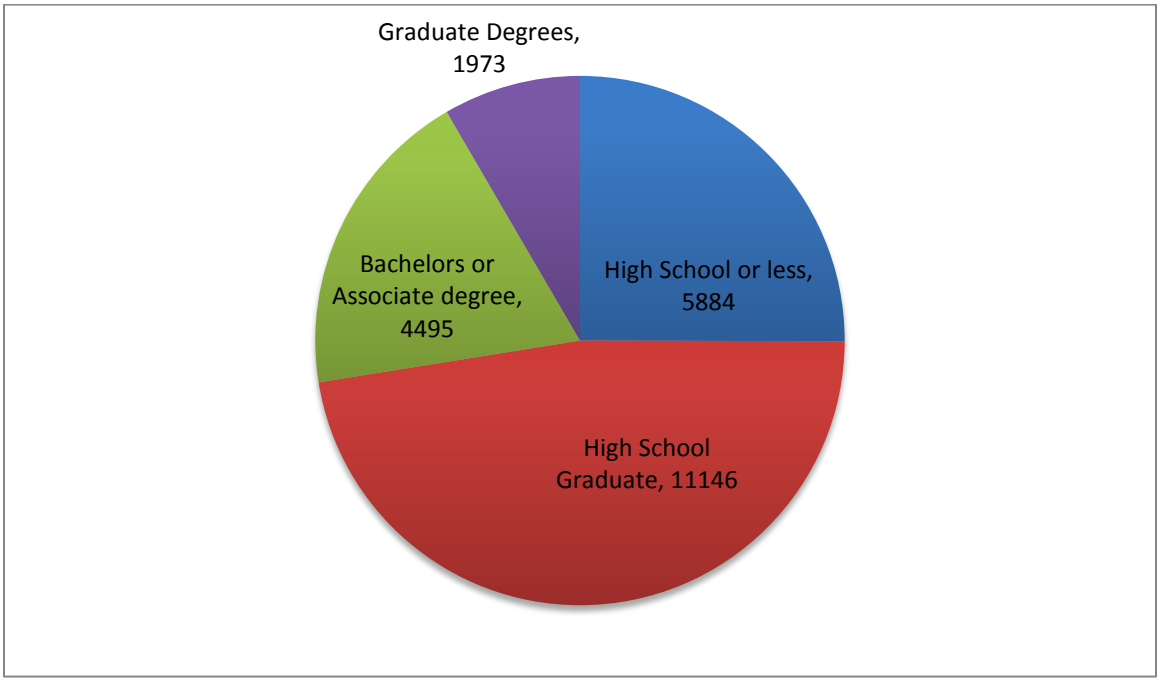


Figure 16: Population by Education Level

The creation of a website will be very useful for disseminating information for achieving the goal of our project. Due to the educational background of the demographic of Worcester our outreach can include and assume many forms, all with the potential of including extensive information. The aim of our website is to be an interactive medium. Members of our target audience will be able to read, click on pictures and explore the content of the site to learn at their own pace. Because of the educational background of Worcester, where approximately 75 percent of the demographic is at least a high school graduate, there has been at least some interaction

with a website during their life time. Because websites are integrated in, not only society but, education as well members of our target audience as well as this demographic have used and interacted with a webpage which allow it to be an appropriate medium.

The Worcester demographic allows for effective use of a brochure for the promotion of rain gardens as well as the educating of storm water runoff problems. This hold true because members of the Worcester demographic that are high school graduates or above know how to read. If they have the ability to read the distribution of this form of outreach as the potential to yield a higher result for motivation of action because the information can be obtain and understood.

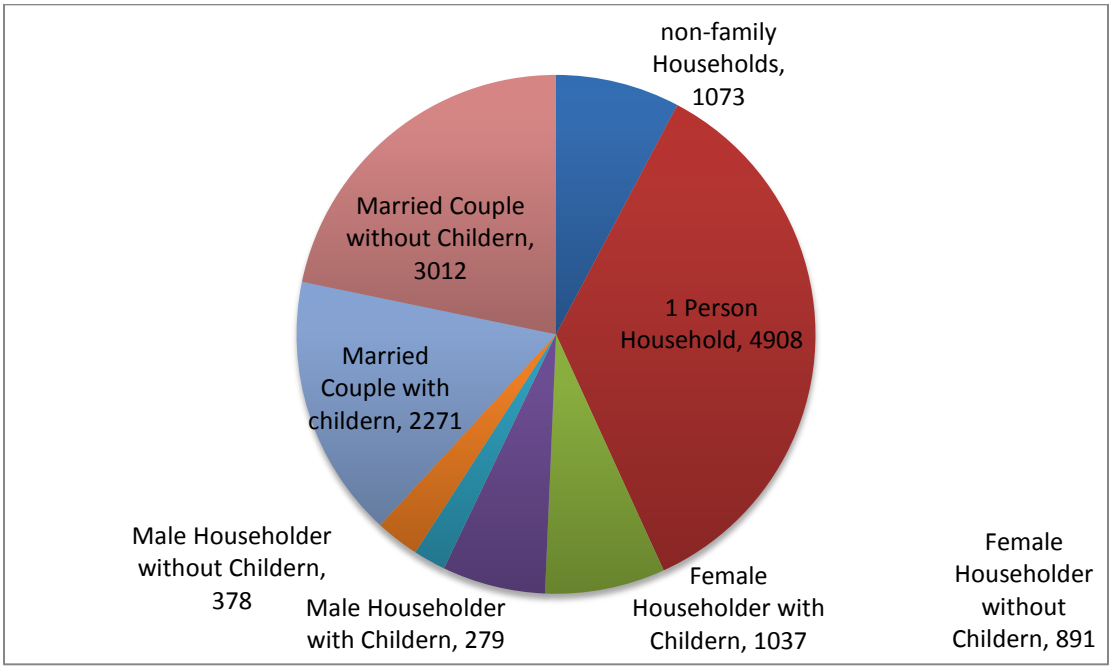


Figure 17: Household Type by Children Present

More than 50% of household in Worcester are families. If they have yard space and are interested in making rain gardens, we can expect that they have some members to help them. We might introduce rain garden as one candidate of their fun activities. In addition, if a family can

explain rain gardens to their children, the kids can go to school and tell the same thing to their friends. This might be one way of making rain garden networks.

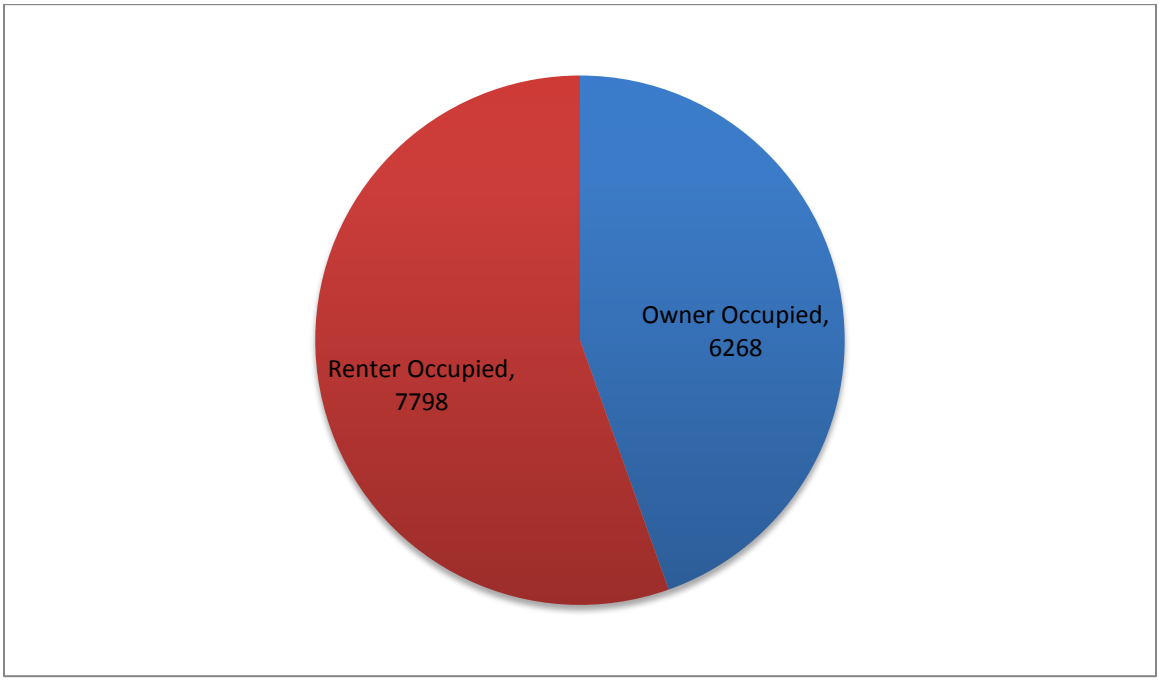


Figure 19: Owner vs. Renter Occupancy

We have a weakness in our project, due to the demographic in Worcester we are limited in the amount of homes that will be initially motivated to build a rain garden. The target audience in the demographic of Worcester is homeowners; the reason for this is because someone is going to less likely to build a rain garden if they don't get to feel the effects of the benefits rain gardens yield. With this in mind, less than 50 percent of the demographic of Worcester has the potential to be motivated to build a rain garden, which brings us at a less than 50 percent success rate even before the project began. With this information in mind we can have an idea of what kind of response is possible based on the demographic of Worcester. Other information to be taking in consideration is the amount of land that this property of homeowners possesses, if they do not

have an enough room for a rain garden even if they are motivated to build one, unless they find another plot of land they can't plant a rain garden.

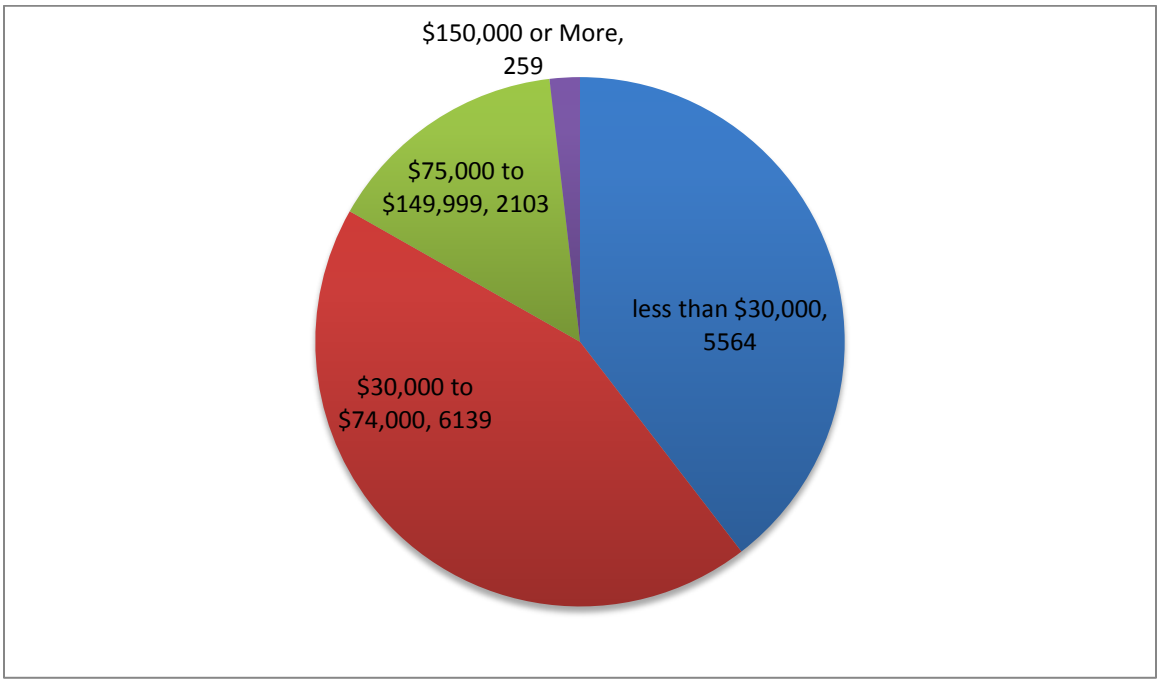


Figure 20: Household Income Levels

The number of people who would consider rain gardens as a possible method for alleviating storm water pollution is decreased based on the data provided in the figure portraying the Worcester demographic. The aim of our project is to promote the awareness of the effects storm water issues as well as educate and promote rain gardens as a method of handling storm water. We hope to inspire individual actions to handle a seemingly insurmountable problem. Unfortunately, one the limitations we have are not only the money, but the mindset that come with it. Based on the advice of our stakeholders, we need to consider what demographic of Worcester would be motivated to build a rain garden. We need to determine what demographic would be willing to build a rain garden. They would have to make enough money to where they

would be able to access the materials motivated by the financial motivating factors, not so much money to where they would mind anyway.

Most Worcester population has income levels between $30,000 -74,999. This might not be a lot, but since rain gardens do not required a large amount of money they can still be easily implemented by a member of this section of the Worcester demographic. Also many organizations are willing to help: they can have some free plants and volunteers, who can help them with making rain gardens, income should not be a big problem of making rain gardens.

With all these factors taken into consideration the demographic of our target audience will be predominantly Caucasian home owners who are at least high graduates with an income of at least $30,000. Another factor that needs to be taking into consideration when considering members of our target audience is interest. Using the contact information provided by our sponsor we will contact members of our target audience who are part of a neighborhood association or a community development center. Reason why we contact members of C.D.C's as well as neighborhood associations is because they have already shown interest in helping the community through their membership with their associations. They've shown that they are already interested in helping the community, and making a change. Through our outreach material we hope to motivate them to want to make a change in their community from an environmental standpoint. but in order to help motivate them we need to know what they know about the problem at hand, we need to know if they know about the problem and if they know about our method of handling the problem, if knowledge on anyone of these factors is missing, the design of our material could miss the mark as far as accomplishing its purpose.

3.2.2.2. Interview the target audience via phone call

Conducting informational interviews through phone call is an effective method to test the target audiences' understanding on flooding, water pollution problems in Worcester. At the beginning of the timeline of the project we received the contact information of homeowners in Worcester, and conducted phone interviews that consisted of specific questions. These questions are based on their background knowledge and opinions on the flooding and water pollution problems in Worcester. The questions also included how they knew about rain gardens. The team tried to make questions concise because they do not want to use long time. If the interview is long and consisted of many questions, people might not want to listen and hang up the phone. In order to collect the answers from target audiences easily, the questions was asked to have answer that follow Likert Scaling Research Methods by Trochim (2006). The questions are multiple choice questions that ask the level of agreement or disagreement. Therefore, the project team could analyze the target audiences' background and opinions on the problem and solution, rain garden, based on the scale of their preference information. Other opened question on how they know on rain garden and problem were also added in the interview. The phone call was conducted following the question sheet in appendix B.

About 50% of target audiences are not knowledgeable on the flooding and water pollution in Worcester, and they want to know on how rain garden can support the environments in their communities. The team conducted phone interviews that consisted of question that would access information based on the listener's opinion. The project team realized that everyone in Worcester to some degree is affected by these issues in some form or another but it is good to know what they think, and where they think they stand as far as being affected by these problems. The team accessed on a scale of 1-5, one being not at all and 5 being very effected by

the problems of storm water and sewer pollution and flooding in the city of Worcester. According to the phone call interview analysis, more than half of the target audiences are not affected by the flooding and water pollution in Worcester. However, the problem significantly and severely affects 40% of successfully contacted members of our target audience. Figure 1 shows how the members of our target audience are affected by the problem of flooding and water pollution.

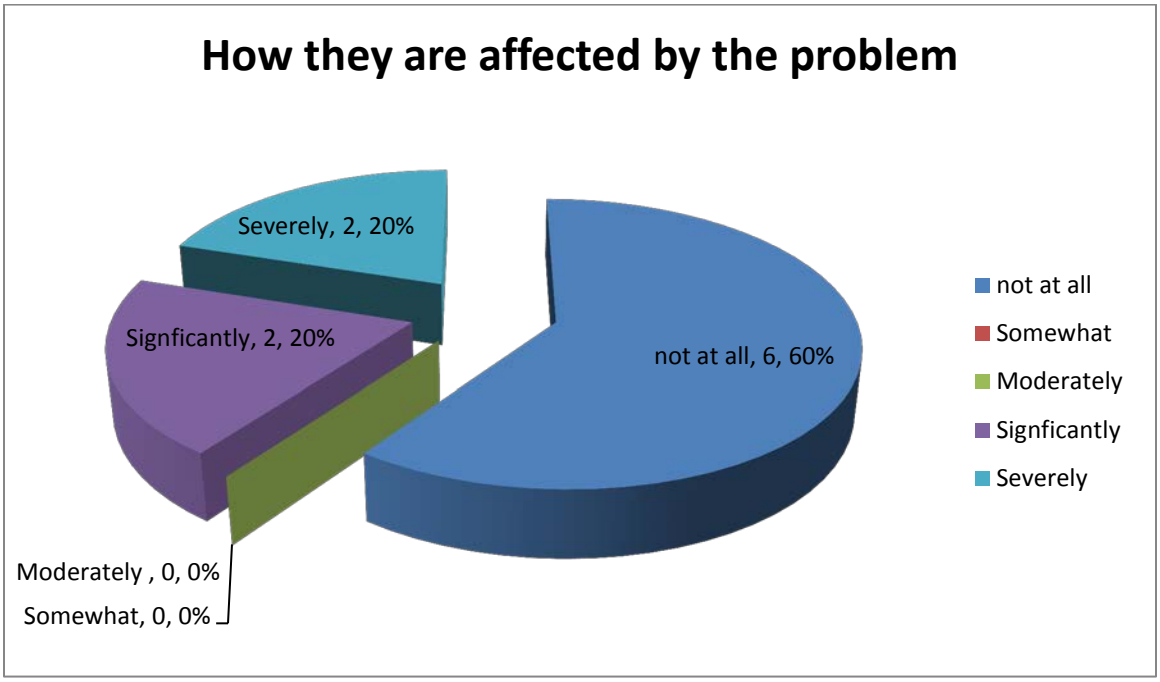


Figure 21: How the target audiences are affected by the problem of flooding and water pollution in Worcester

This data was collected based on the process of initially asking if they were familiar with the accounts of flooding and water pollution here in Worcester and then asking whether they were personally affected and to what degree on a 5 point scale from not at all to severely. Because 50 percent of the contacted members of our target audience are not affected by the problem, they do not know about the problem. With this information in mind we needed to take into consideration how significant the background information of our outreach should be, realizing that it may be the first time members of our target audience are exposed to the reality of this issue.

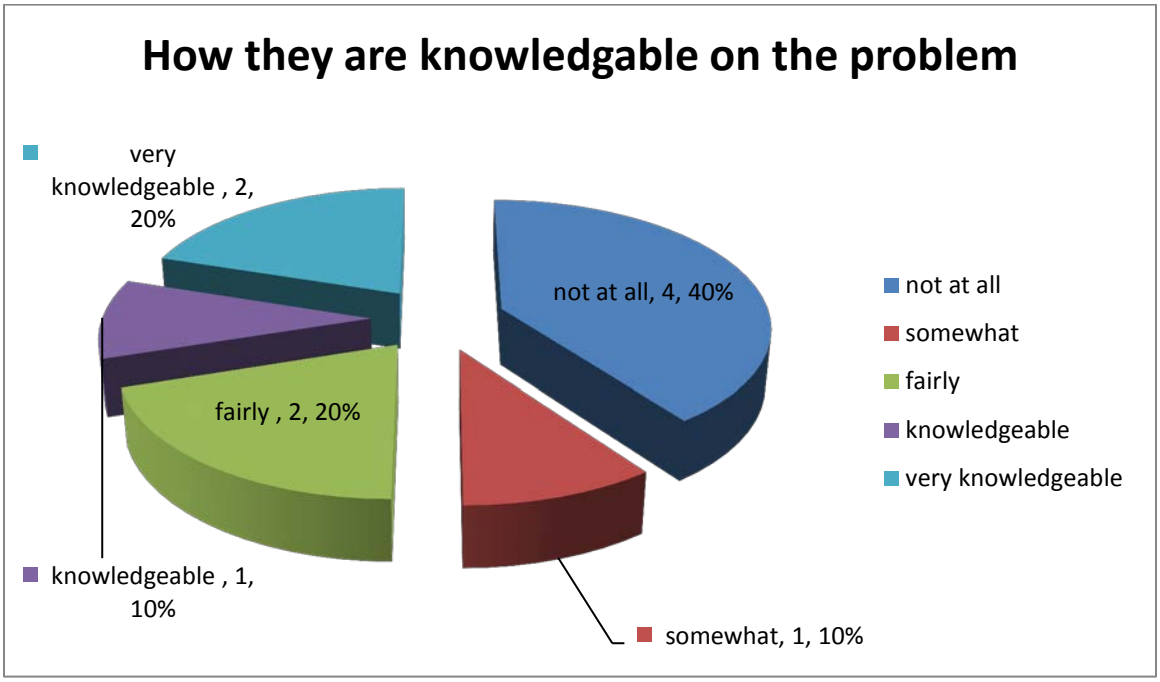


Figure 22: How the target audiences knows the problem situation in Worcester

This section of the interview we wanted to assess whether they knew about the problem of Worcester being fined for dumping sewage into the Blackstone River, and whether the contacted members of our target audience were aware of the dumping of sewage to begin with. This information was also gathered over the phone, by asking the above question and gauging on a scale of 1 to 5 how knowledgeable they felt they were on this problem. According to the phone call interview, 50% of them felt they were fairy and very knowledgeable on the problem while the other 50% felt that they were somewhat knowledgeable and not knowledgeable on the problem. Figure 2 shows how the target audiences know and understand the problem situation in Worcester. This question holds significance in the interview because it helps us understand how much they believe that they know. Although there is a significant difference in how much people know and how much they believe they know, we need to take into consideration what they

believe because it will have stronger influence when it comes to them accepting and being motivated by our outreach material.

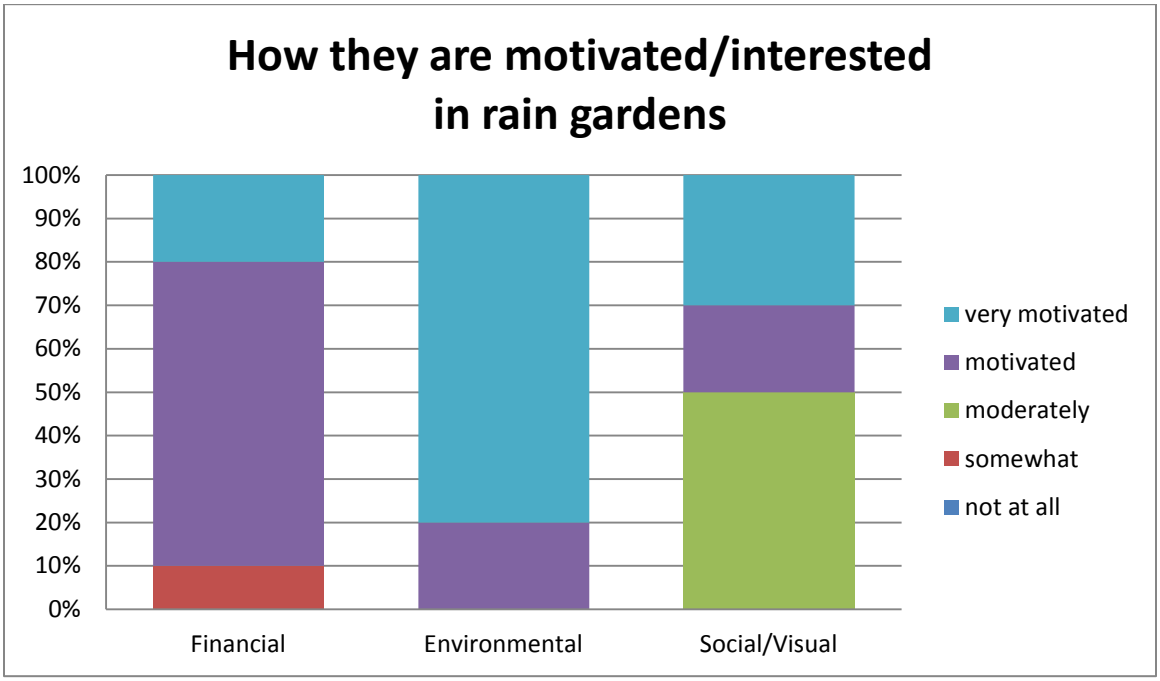


Figure 23: How the target audiences are motivated via different aspects of rain garden

Next, the project team would like to know familiar members of our target audience are about rain gardens. When collecting data for this question, it was first asked if our target audience knew anything about rain gardens to begin with. If they didn't, a short explanation was given explaining 3 aspects about rain gardens. These three aspects were social/visual, environmental and financial. We asked them what aspects would motivate them the most, as well as on what scale would it motivate them. We assessed from the data of the members of our target audience that the environmental aspects of a rain garden proved be to be more important in general as most of the responses are in the category 5 and 4 of importance. Then Financial and Social/Visual as important aspects of a rain garden in their eyes. The target audience, based off the responses of the contacted members, appears to be more interested in the environmental

aspects of a rain garden. Figure 3 shows how they feel interested and motivated in the different aspects of rain gardens: environmental, financial and social/visual aspects.

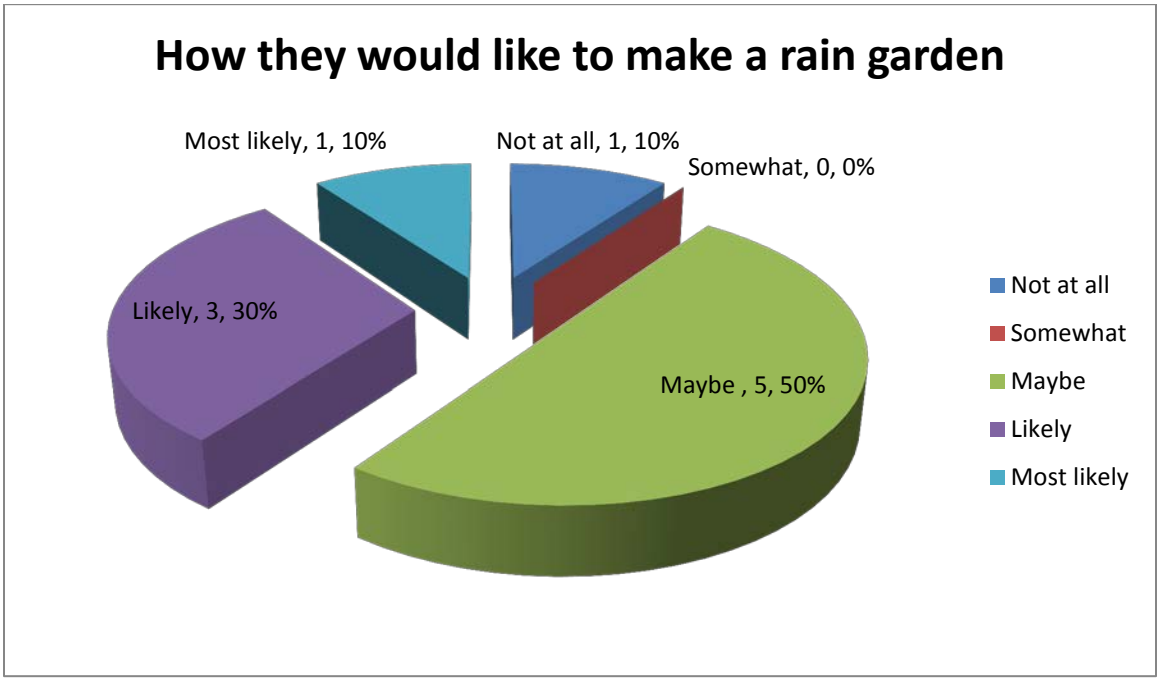


Figure 24: How the target audiences would like to make a rain garden with provided resources

Lastly, after giving a brief explanation of what a rain garden is and assessing what aspects of a rain garden are important to them, the we asked if they would be willing to build one if they had the available resources to do so. We asked this question because the team wanted to get honest answers about if they would build one. Sometimes if you ask someone if they would be willing to do something they use an excuse relating to finances to stop them. By stating, "so if given the resources…" we were able to get a better assessment of what would prevent them from making one. This includes time constraints, lack of knowledge of what it entails, or even lack of interest. Figure 4 show how the target audiences feel likely to make their own rain garden.

By understanding of defined target audiences and their background knowledge that about half of them do not know about Worcester sewage overflow problem and rain garden, we had ideas that can use to apply our media messages. We realized that Worcester homeowners who

are facing flooding and interested in rain garden, would be our great candidate for target audiences. If they have yard space, and average income, they should be able to build a rain garden, which we could provide them more information by developing media. By making a phone call, we also had target audiences who were interested and able to come to give us feedback on developed media. Since we asked them to see what aspects of rain gardens can motivate them, we were able to develop media messages and purposes of media in order to accomplish our project goal.

3.3. Finalization of Media Messages/Themes

Message or themes of the outreach: brochure, video and website are developed according to the sewage overflow problem in Worcester and background of our target audiences' analysis. Media's message for brochure, video, and website that develop to the target audiences are:

That rain gardens are an alleviate to the problems occurring in central Massachusetts concerning storm water management. They purify water of chemicals and pollutants, as well as reduce flooding in the area. They are a method that can be employed by anyone who is interested, and has the time, land and a small amount of financial resources. The message of our project speaks to anyone who is interested in making a change in the community or handling the effects they feel individually from this problem.

Media's messages are developed to shows that outreach will provide understand and persuade people on making a rain garden along with realized the problem that being simply solve by rain garden. The messages are developed base on the problem and target audiences' opinion and background. Knowing the messages/themes, develop of the outreach: brochure, video, and website are going to follow the messages and media's messages guide each medium's purposes

3.4. The Models of designing effective media

In order to develop effective media, we studied a method or model that can help to create and evaluate the media. We were applying a model called Analyze, Design, Develop, Implement, Evaluate, or ADDIE and Analyze, Plan, Generate, Assess, and Revise, or APGAR, to be DGAR. DGAR are determine, generate, assess, and revise. This section is going to cover the development of DGAR, and how the project would follow the DGAR model

3.4.1. Instructional System Design

Instructional System Design (ISD) is a method that helps to design and evaluate informational media. This method helps the creator to design effective media products. Media analyst Clark (2010) uses a model called Analyze, Design, Develop, Implement, Evaluate, or ADDIE, to evaluate and determine a medium's ability to be successful. This ADDIE analysis strategy was studied to shows how the proper use of media can make success. By studying ADDIE model, they provided that the analysis is important to help the planning before develop the media. Without analysis of content before going to design phase tend to cause a problem of design and develop. Each phase is related to each other and help to move to the next step to create effective media. Also, according to, *Teaching Educators about Sustainable Development: Developing an Effective Series of Informational Brochures and Educational Videos on Wood Vinegar, Biofertilizers and Biogas*, an Interactive Qualifying Project that was conducted at Na Yao school, a school located in Thailand, that adapted ADDID to a new model called, Analyze, Plan, Generate, Assess, and Revise (APGAR). This model helped them study how their media's development and success in provide message properly and strong dissemination thorough the target audiences. APGAR provides similar idea to our project more because we need to assess target audiences in order to make a revision for the final product media. By researching on how

they move to assess and revise phase, it guided us that the media that are created in this project need to have feedback in order to improve to become complete and effective media. APGAR bring us to understand the development of media which need to be able to use in actual communities of target audience. By applying both models, we developed 4 stages strategy of media development: determine, generate, assess, and revise (DGAR). In order to develop effective media that can transfer messages and follow the themes of media, we followed DGAR. This guideline can help us to achieve each component of the media. DGAR model consists of 4 stages: determine, generate, assess, and analysis.

DGAR	Accomplishments		
	Brochure	Video	Website
Determine	- Define purpose according to messages/themes - Define contents that are follow the purposes - Determine design and other elements that are related to each media Ex. Research on layout for brochure, planed to make a video script for the video, study on site map for the website, etc.		
Generate	Make 3 basic brochure	- Make video script and storyboard - Shoot and edit video	- Make a website with proper pages following determined elements
Assess	Interview sheet	Interview sheet	Usability Test
Revise	- Make revise version according to assess step - Finalized product: brochure, video and website		

Table 6: DGAR

According to table 6 that shows how DGAR apply to each medium's accomplishments, the determine phase is mainly to analyze and plan purposes, content and other design elements. Next is generate phase. We created media by following element that were analyzed from determine phase. Then, assess phase helps to collect feedbacks from target audiences. Finally, revise phase

finalize media due to collected target audiences' feedback from assess phase. This section is going to cover more on detail of accomplishments in each phase of DGAR.

Researching, analyzing, and planning were done in the determine phase. The first phase is a determine phase that is working mainly as a planning phase. In this phase, we needed analyzed the purpose of each media after researched on how each media work. By understanding the analyzed purposes of each media, we analyzed the media's contents. In order to accomplish media's content; we researched on how to develop content for each medium, brochure, video, and website. These contents are different due to the purposes and contents strategies of media. For example, brochure has a lesser space than website. Also, brochure disseminates information in verbal forms that is not able to maintain focus of the audiences much. Therefore, contents in the brochure are going to be mainly on rain garden with a series of important information instead of explanation of the overall problem situation in Worcester. Each medium's purposes and contents were developed in determine phase, and they are going to be covered in more detail in the next chapters of each development of medium.

In the determine phase, the important aspects or missions of each media need to be identified prior. During this phase, the members determined the primary requirements for their brochure, video, and website. All component of each medium have been identified and analyzed in order to develop great media. Other elements are also needed to study in determine phase. For brochure, we identified layout and design elements that are best fit to transfer message to the target audiences. As well as video, we researched on component of best commercial video. In order to conduct best promotional video, researched on promotional component that can help create a great commercial video is important. Also, video script and storyboard were mainly studied at this phase. Lastly, sitemap and navigator elements were analyzed for planning of

website development. We test sitemap with the stakeholder to see their feedback. We determined navigation, layout, content and aesthetics for the website. We understood website elements that are needed to ready to accomplish. All media need to have their synthesized important design aspects in this determine phase.

The second step is a generation of media. In this phase, we created the media according to what had been researched, analyzed, and synthesized in the first phase. We created 3-fold brochure with 6 panels. This is because the 30-fold brochure with 6 panels is commonly used nowadays. Brochure was created to have three different appearing styles. This is because they can be tested how target audiences' preference in each style. Video script was written in this step before promotional video was conducted. The promotional video that we created is about 5 minutes long. For website, it is created by following missions or requirements that are needed to achieve in determine phase. All media were generated in this phase by following their analyzed contents and design aspects from determine phase.

The third phase is to assess the target audience to figure out their positive and negative opinion on the media. Bear (1997) stated that suggestions from audiences should be received in order to revise and finalized a great product. Therefore, in this phase, we conducted interviews with questions sheet for brochure and video. In this interview, we followed the strategy explained by Bailey (1994) that we need to convince their honest responses are important to help us finalized the best media to disseminate the information. The interview tried to have questions that help the forward truthful responses from the target audiences. Unfortunately, video was not able conducted assess phase with actual target audience due to time limitations. However, we tested video with the stakeholder: the sponsor, Blackstone River Coalitions, and advisors. This helped us to collect feedback in order to improve the video in the next phase. For the website,

we conducted usability test in order to collect the feedback before revise until accomplish the final product. In this phase, we collected feedback from target audiences in order to make revision fort each medium in the next phase.

The final phase of DGAR is revise that allow us to make changes and finalize the products. According to Media analyst Bear's statement (1997), he point out that media prototypes should be revised based on the information collected feedbacks. In this phase, we analyzed the results of their assessments and identified tasks that are needed to improve in each medium. For brochure, we finalized the tasks to be based on content and design category. We revised introduction part that is needed to ensure how people understand the topic of rain garden. Also, the cover of the brochure that is needed to grab the target audiences was also revised to fit the aspect. Other feedbacks that we revised for brochure are such as larger pictures, preference pictures, font, etc. For video, we revised due to the opinion from the stakeholder. The tasks that we revised for video are improvements of contents, limitation of time, and suggestions of images, audios, and videos. For website, we revised according to target audience's preference, and suggestions from the stakeholder. The revision in revise phase helped us edit and finalize the website to accomplish the website purposes. Other revisions of each medium with detail are provided in the development of each medium chapter. We finalized the media to fit the feedback of target audiences this phase. With achieving this revise phase, we have final product of brochure, video and website.

DGAR model: determine, generate, assess, and revise phases help us to develop the great media in this project. After purposes of each medium were identified, we analyzed content and other important missions in order to create the media in the next phase. Generate phase is to develop media. The generation of media are occurred according to what have been analyzed in

the determine phase. With having basic designed of each medium, we conducted interview for brochure and video and usability test for the website to collect the feedbacks from the target audiences. After receiving all feedback, we were moving to revise phase. In this phase, all media would be revised and finalized. With following the effective series of DGAR model, effective brochure, video, and website were developed. Table 6 shows how we worked in following the DGAR strategy.

By understanding how each medium are different and supporting each other, we were able to develop the effective media, brochure, video, and website, that following defined media messages and corresponding to DGAR model. Brochure, video, and website are different in their strengths and limitations. Brochure has high accessibility with less technological aspect requirement. Video's able to engage viewer than brochure. This can help to motive viewer. Website can provide complete information and keep update activity. So, users can participate most. With their difference of strengths and weaknesses, a properly composed multi-media approach combines the strengths of each different type of media and minimizes the weaknesses. We conducted the phone call survey to understand their knowledge background on the Worcester sewage overflow problem. By analyzed the problem and target audiences, we defined media message to be mainly on sewage overflow, water pollution, and rain garden. This is because about half of target audiences do not know about the problem. We would develop media: brochure, video, and website, according to media message and following DGAR model: determine, generate, analyze, and revise, which we are going to cover in the next chapters.

Chapter Four: The Development of Brochure

In this project, brochure is going to act like an advertisement that bring Worcester communities or the target audience to be interested in making a rain garden along with provide behavior change on environmental issues, especially flooding and water pollution in the Blackstone River. In the present 3-fold brochure with 6 panels is most common. So, we decided to develop the 3-fold brochure. In order to create the brochure to achieve the purposes, we followed four stages strategy of media development model that was adapted from chapter 3, DGAR: determine, generate, assess, and revise. There are specific aspects that we needed to accomplish in order to develop the brochure: contents, layout, design principles, and colors. By applying these aspects, we created three brochures with different styles of appearing. Then, we conducted interviews with focus groups to collect the feedbacks from target audiences. In addition, the brochure was also showed to stakeholder: the sponsor, advisors, and Blackstone Water Coalition researchers. We analyzed the collected feedback and then, we revised according to each analyzed tasks in order to have the final developed brochure as they were shown in figure 25 below.

Figure 25: Final brochure

Figure 25 shows the final brochure's outside and inside respectively. This is a final version of brochure that we revised according to analyzed feedbacks from our target audiences and stakeholder. This chapter is going to cover how we analyzed and identified purposes, contents, layout and other design elements, and we will discuss in more detail on how we finalized our rain garden promotional brochure.

4.1 Brochure Purpose

A brochure is a way to persuade the Worcester community to build a rain garden as well as to inspire behavioral change on environmental issues, such as the flooding and water pollution in the Blackstone River. Bear (1997) pointed out in his guideline of creation, that brochures are one way that can help the designer inform, educate or persuade readers with proper but limited amounts of information that is enough to grab the viewers' attention. The brochure's purpose here was to develop materials according to the media messages talked about in chapter 3. Since parts of media messages are to introduce rain gardens and persuade Worcester homeowners to make their own rain garden, this brochure introduces rain and gives detail to those who do not know about rain gardens. Professional Advertising (2005) defined this type of advertisement as a way to attract a new client's attention. The brochure was designed to grab the attention of Worcester communities who were previously unaware of the benefits of rain gardens. Due to the limitations of content that fits in a brochure, there is not much information about sewage overflow and water pollution problems in Worcester. However, the brochure does introduce some of the flooding and water pollution problems in the Blackstone to ensure that our audience is aware of the specific purpose of rain garden. Since the brochure has the ability to access communities with less technological requirement, the use of a brochure was selected to introduce rain gardens and persuade Worcester's community to build one.

4.2 Brochure Content, Layout, and Design Elements

To design an effective brochure, we considered and defined the content, layout, design principles, and colors aspects. These aspects helped us figure out what style brochure we should provide, the type of layout, which colors fit best, and which style we should develop. We defined the content according to the strategies for determining the brochure's purpose and content. We also researched a basic layout of a 3-fold brochure containing 6 panels, to figure out the proper location for the content in each panel. In addition, we studied design principles and color methods that were considered to design the brochure. This section is going to cover how we research and determined the brochure's content, layout and design elements.

4.2.1 Brochure Contents.

The brochure's content as designed to follow the purpose of the brochure that will persuade the target audience to make a rain garden as well as to inspire behavioral change on environment issues. With limitations of brochure space, the content was synthesized before designing the brochure. The content used promoting the use of rain gardens was organized following a set of strategies. The strategies that were applied for the brochure development are shown below in table 8.

#	Content strategies
1.	- Readers do not prefer too much text.
2.	- Should provide only 2 -3 important describe points, and the other should be listed in simple bullet or chart.
3.	- Should be written professionally.
4.	- Needs to grab people's attention.
5.	- Using great quality pictures.
6.	- Choose content to the brochure needs to carefully think of benefits of the brochure, or what the creator want from reader after they read the brochures.

Table 7: Brochure content strategies

According to table 7, brochures should provide only 2 -3 important descriptive points and the rest should be listed in a simple bullet or chart form. This is because readers do enjoy being overwhelmed by large amounts of text. All of the content should be written professionally and ready to sell the product to the readers as if they were customers. The sentence or writing style needs to be organized and professionally done as well as adding appropriate pictures to the content. All of the content should be synthesized professionally with less text, and more pictures.

In the preliminary steps of creating the brochure, we identified strategies to apply to our brochure content. The brochure content was defined according to the purpose that it is going to persuade the target audience to make a rain garden as well as to inspire people to make a difference in a seemingly surmountable problem. This content was organized according to Professional Advertising webpage's suggestions (2005) as previously described. By applying the strategies used to generate the content of the brochure we were able to develop an effective and professional brochure.

4.2.2 Brochure Layout

The panels of a brochure are the specific locations for different content. We need to consider how a 3-fold brochure layout looks. John McWade (2009) defined that "layout is where

those lines, shapes, spaces, colors, and textures finally get put to work (p.12). The layout shows the overall image of the designed brochures after the various components are put together. By observing many existing brochures and researching Printplace's brochure layouts' suggestions (2011), we defined basic layouts of 3-fold brochure with 6 panels as is shown in table 8 below.

Panel#	Description
1st panel/ first panel	- grab people's attention. - make reader want to read the brochure more. - use pictures and provide benefit as a headline is better than just put logo. -working as an advertisement.
2nd panel	- reader will look at this before open to see panel 3 and 4. - explain benefit of the product. - introduce why the information is necessary for them.
3rd panel	- the introduction to the first call for action. - benefit, great graphics, and a call to action.
4th panel	
5th panel	- emphasize the call to action. - tell the reader exactly what you want them to do right now. - tear-away order form, a ticket to an event, or sometimes extra information such as testimonials. - frequently asked questions.
6th panel	- names and contact information. - resources for information.

Table 8: 3-Fold brochure basic layout

Table 8 describes how each panel works by observing existing brochures, including the suggestions from the Printplace website (2011).

The front page or 1st panel is what grabs people's attention and makes readers to want to open the brochure and read it. Printplace (2011) suggested that to use pictures and to provide benefits as a headline is a better way to spark people's interest than just putting the logo. This panel should use high graphic design, large pictures, and other highlighted visuals to pop out to

target audience. This first panel is working as an advertisement and should encourage the readers to want to take it with them.

The 2nd panel is the most important because this is what the reader will look at before they open to see the 3rd and 4th panels. Panels 2, 3, and 4 are shown when the readers open the brochure completely. Headline, images, and boxes can go across these three panels. Panel 2's space should spread most of the information because the reader usually reads the left panel before they open to the 3rd and 4th panels. The 2nd panel explains the benefits of the product or introduces why the information displayed is necessary for them to open the brochure and read.

The center or 3rd and 4th panels should cover the introduction to the first call for action. This should provide the benefits, great graphics, and a call to action. The action in this brochure is making a rain garden. Therefore, this part should grab the reader's attention as well as provide them with what we want them to do. Because panels 3 and 4 work together, we connected both panels to support each other. This corresponded to Kim Golombisky and Rebecca Hagen (2010)'s statement that a brochures layout works like a tour guide that welcomes visitors or readers from a starting point and leads them to be engaged until the finishing step (p.70). Therefore, the content in panels 3 and 4 can work together to enhance reader to feel more engaged with the information about rain gardens.

The 5th panel should emphasize the call to action. This part should tell the reader exactly what we want them to do. It often includes tear-away order form, a ticket to an event, or sometimes extra information such as testimonials. This panel can also include frequently asked questions. Since the brochures purpose is to persuade the reader to make a rain garden, we needed to consider how we can encourage them to make a rain garden.

The last or 6th panel includes resources and contact information. This part helps the reader or target audience have more support by going to the various resources we provide them. In addition, the contact information is useful for any additional questions they may have. Most existing brochure materials demonstrated that the 6th panel should not have much detailed information. So, this panel should not add more information or more visuals but the logo. This panel should not provide more information other than resources and contact information.

Research on different panel strategies helped us to figure out how each layout works. So, we could considered where should add contents. Research on panel strategies helped us understand what each panel should contain and how each panel compliments the next. This allowed us to organize the brochure so that the reader is able to easily read the brochure. It also corresponds to a statement by McWade (2003) that explained that brochures are organized panel by panel (p.45). Therefore each panel should provide some idea or guide to the next panel by following the necessary layout strategies described.

4.2.3 Brochure Design Principles

The brochures content and layout design followed the 4 basic principles: contrast, repetition, alignment, and proximity. Robin Williams explained in the introduction of his Non-Designer's Design book that these principles are needed to learn and apply in designed for efficiency. The principles used when creating the brochure were mainly from Robin Williams (2003): contrast, repetition, alignment and proximity. Table 9 shows how each principle worsk to design a brochure. This section is going to cover how these design principles apply to our brochure.

#	Principles	Explanation
1	Contrast	- help to avoid similar content - makes a reader looks at the outreach in the first place
2	Repetition	- repeat on visuals, such as color, shapes, texture, … - develops unity and professional of outreach, so reader will recognize them - avoid repeating too much because it can annoy readers
3	Alignment	- helps visual and element in the outreach to be connected - better way to avoid put everything in the center; be conscious to add element in the page - creates clear, sophisticated and fresh looks to the outreaches
4	Proximity	- helps to organize information and reduce clutters - similar content will be grouped together - not just put in the center or corner because of avoiding having space

Table 9: Well-designed work principles

Table 9 shows brief ideas of how each principle works.

The principle of contrast was mainly used for the focal point of the brochure. Williams (2003) explained that contrast can be types, colors, size, line thickness, shape, and space, etc (p.63). Contrast can draw a reader in and encourage them to read the brochure. Therefore, it should be applied to the cover or 1st panel and the center, where we give the call of action. In addition, contrast helps to avoid the use of similar content and make the content more visually appealing to the reader. Contrast enhances ability to grab people's attentions, so it would be applied mainly on the brochure cover page.

Repetition was used to create a sense of unity throughout the brochure. Repetition is a repeat of visuals, such as color, shapes, texture, spatial relationship, line, thickness, fonts, sizes, graphic, etc (p50). According to research done on many design works including websites, print media, audio, and video, etc., the website needed to have repetition most. This is because the website needs to ensure its viewers that they are still in the same website pages. However, the brochure can apply within this same principle. Repetition helps designed work look formal and

professional. Yet, according to our researches and observations from existing brochures, the repetition of too much content and style can make the brochure seem boring and unappealing. Therefore, we decided to apply repetition along with some contrast principles in the brochure. Applying this repetition makes the overall brochure looks organized and professional.

Alignment helps the visual appeal of the brochure and allows areas to be connected. We realized that most creators might want to put everything in the center because it looks more organized, however, there is a better way to avoid putting everything in the center and be conscious to add elements in the page (p. 32). Alignment helps to avoid arbitrary visuals and elements. This corresponds to an idea given by Golombisky and Hagen (2010) that brochure works like a tour guide that welcomes visitors or readers from starting point and leads them to be engaging until finishing step (p.70). Alignment helps to create a clear, sophisticated and fresh look to the brochure.

Proximity allows groups and organizes the brochure visual and elements. It helps to reduce clutters for the reader because similar content will be grouped together. According to observing from existing brochures, applying of proximity principle helps reader to understand the brochure's structure and look for information easier. The entire of developed brochure was applied with alignment principles.

4.2.4 Brochure's Color Method

The brochure mainly used blue and green with some of the other strong colors to enhance contrast principle. Robin Williams (2003) conclude on use of colors chapter that there are many triads of colors that can be used. We should know how basic color categories. The first is primary color. Primary color cannot be made up by combining any color. The primary colors are yellow, red, and blue. The secondary colors are the combining of primary colors. They are green,

purple, and orange. The tertiary colors are also occurs after combining the secondary colors. These basic colors rearrange to make triads of colors. Triad is a set of colors. Table 10 shows basic 4 triads of colors.

Triads	Description	Examples
The complement	The opposite colors	- Blue and orange - Red and green
The split complement	The nearly complement colors	- Blue and Yellow - Red and light blue
The analog	The near colors	- Blue and purple - Red and orange
The monochromatic	The same color with different shades	- Dark and light blue - Dark and light orange

Table 10: The four different triads of colors

According to table 10, triads might include the complement or the opposite colors triads as are shown above, blue and orange, red and green, etc. The split complement or the nearly complement colors, which are blue and yellow, red and light blue, etc. The analog color or the near colors are blue and purple, red and orange, blue and green, etc. And, the monochromatic colors or the same color with different shades are, such as dark and light blue, dark and light green, etc. According to different triads of colors, we figured out those analog triads, blue and green, were fit the brochure purposes themes that are dealing with green environment issues.

In this project, we applied warm and cold tones to enhance the contrast. Colors can also be considered as tones, warm, cold colors. Tones of colors are happened due to availability of brighten, deepness, and contrast. In the chapter of use of color by Robin William (2003), warm colors are colors that usually contain red and yellow while cold colors are colors that have blue inside them. Most design use warm colors for font and cold for their background. In this project, to express higher contrast principle for the call of action, we switched warm colors that usually are font colors to be the background colors. Then, cold colors tones switched to be the font

colors instead of background. We figured out that this background colors can be colors from Worcester logo (figure 26).

Figure 26: Colorful of Worcester Logo that can be applied to the development of brochure

According to figure 26, the strong colors from Worcester logo, such as brown, orange, purple, and red can be applied in order to develop contrast. These colors should pop up to readers' eyes among other basic blue and green colors. This helps to enhance the expression of the figure or table that is applied with these colors.

The brochure is mainly designed with green and blue and Worcester logo colors for some contrast element. By applying colors method to design principles, we figured out colors that would be used in the brochure. Since blue and green, one of analog triads, can well represent green communities or environment, we used them as main colors. For contrast, we applied Worcester logo colors because it show a contrast from blue and green, main colors. Also, it repeats our logo that we showed in the cover page. The brochure was going to applied with blue and green mainly and some contrast colors that is inspired by Worcester logo colors.

4.3 Brochure Outcome and Discussion

By applying of our researches on contents, layout and design elements, we developed the brochure. We finalize brochure by applying contents with layout and design strategies including revision that were according to target audience feedbacks. In this section, we are going to refer to

contents and layout strategies that explain how we developed and added contents on each panel. Also, we are going to cover how both design principles and colors method applied in the development of brochure. This section is going to discuss how we applied contents, layout, design principles, and colors in each panel of the brochure.

4.3.1 The Development of the 1st panel

The 1st or cover panel works to grab people's attention and made reader should want to read the brochure more, so it needs large graphic design with high contrast principles. This is a focal point that we want reader to look at the first place. Therefore, we applied contrast here. We developed different style of contrast on the cover by not just adding a logo as we show in figure 27.

Figure 27: The three different style of brochure covers

According to figure 27, title on the three cover pages were great quality and large. The right one used highest graphic design font. The pictures on each cover were different in size and numbers. In addition, we applied some highlighted important facts and benefits on rain garden on the center and right brochure's covers. After revised according to target audiences' and stakeholders' feedback, we have a final cover design for the brochure. The final cover is demonstrated in figure 28.

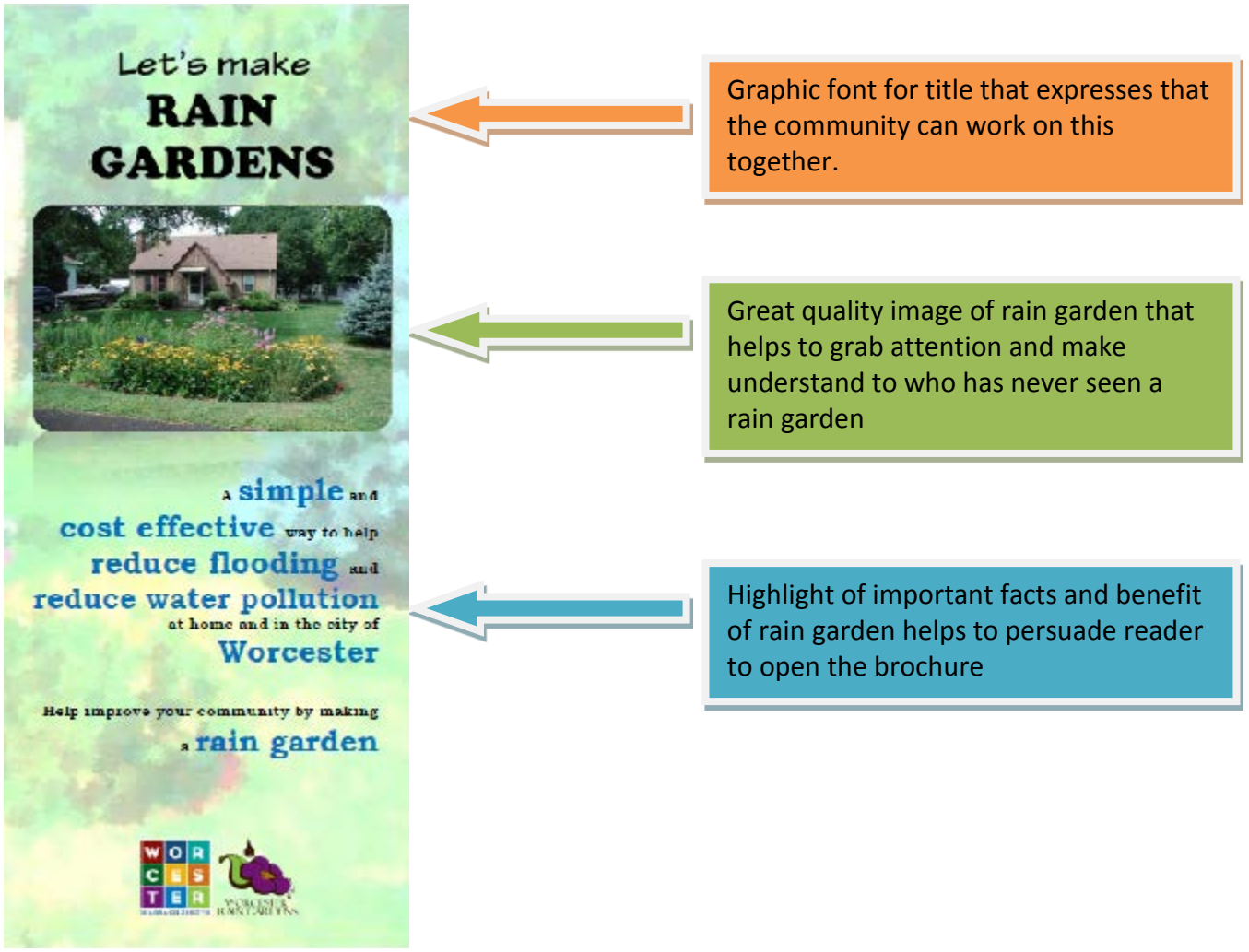


Figure 28: Cover Panel of Brochure

According to figure 28, we realized that target audiences liked a large picture of beautiful rain garden on the cover page. This is not only helps to grab reader's attention, but it also make the target audience see how rain gardens look. Graphic font of "Let's make a rain garden," implies that rain garden can be built by everyone in the Worcester community or this can be worked together. We adjust this font to be in organic them following our brochure's purposes. Important facts and benefits of rain garden were also highlighted on the 1st panel. These should work together to make reader looks at the brochure at the first place.

4.3.2 The Development of the 2nd panel

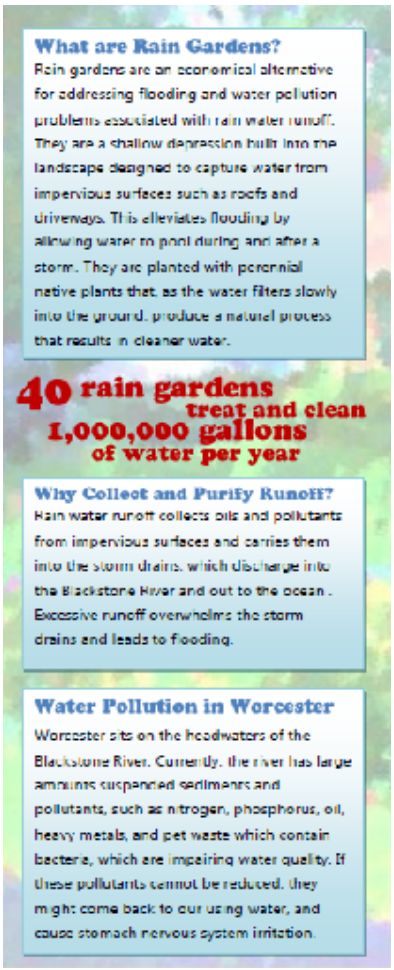


Figure 29: Panel 2 of brochure

Panel 2 works to introduce rain garden as a form of questions and answers that are short and understandable. Since readers do not prefer too much text, we described in form of questions and answer. The 2nd panel is shown in figure 29. We provided brief explanation on rain garden at the beginning. This was covered on how rain garden looks like, works and benefits. We explained that rain garden can alleviate flooding and filter runoff of rainwater. Then, it was connected to why rainwater needs a rain garden to soak and filter. The contents in each part were well connected in order to bring reader to look through the brochure easily. Target audiences should have an idea that this brochure is going to talk about rain garden. The brochure shows most the same color and font type letters of text. They are in the same light blue boxes style. This explains repetition principle. However, we highlighted cool fact sentence a rain

garden's cool fact that, "40 rain garden treats and clean 1,000,000 million gallons of water per year." We used warm brown color that is derived from the Worcester logo as we mentioned before. This help to bring reader to open to the next panels of the brochure. This followed what was mentioned previously that brochure needs to organize and guide reader from panel to next panel. According to the feedbacks, we improved contents connection and writing style and restate the introduction part of rain garden to be a form of storytelling. We also reduced too scientific or technical terms and replaced them with simple understandable words. Because the project team was created contents to express feeling of friends' conversation to the target audience, vocabularies and sentences are needed to follow the same expression theme. We integrated our researches on brochure design principles and the target audiences' feedbacks to finalize the 2nd panel to have a great introduction of rain garden that make reader want to know more about it.

4.3.3 The Development of the 3rd and 4th panels

The center, panel 3 and 4, covered the important information on rain garden and first call for action that we want the target audiences to make a rain garden. This should provide benefit, great graphics, and a call to action about making a rain garden. Figure 30 demonstrated a table that we applied to give a first call for action to reader.

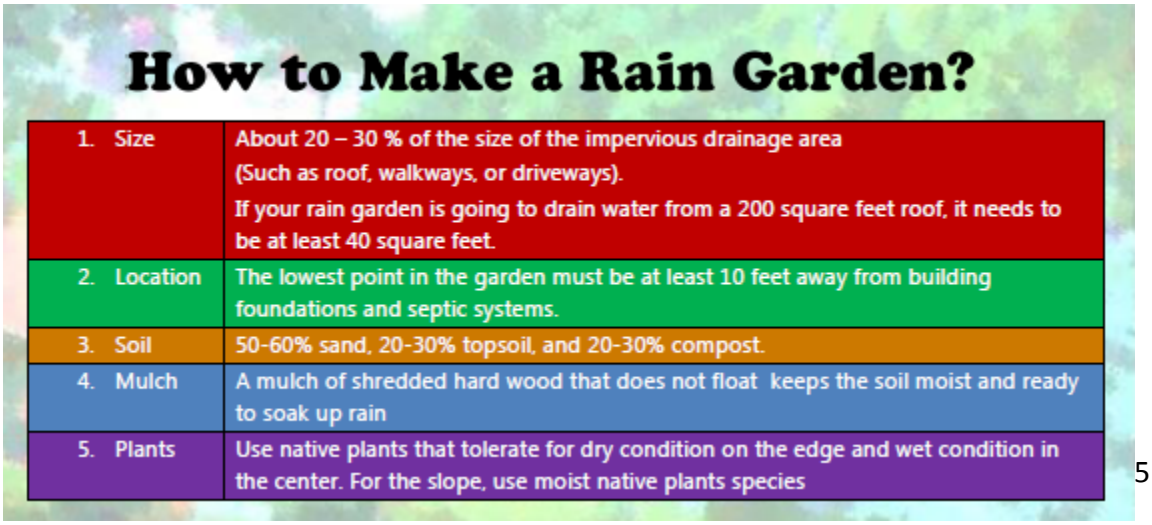


Figure 30: Diagram of how to make a rain garden in brochure

Figure 30 above is the table of how to make a rain garden was added in the top center with strong color to grab reader's attention. The table of how to make a rain garden in the center was also enhanced color contrast. This colorful design was adapted from the Worcester logo colors (figure 26). We expected the table of colors helped the text to pop up more among the other contents in blue boxes because this part is important to call reader to ready to make a rain garden. The contrast here enhances reader to look at the table and read through the process of making a rain garden from the beginning until end.

Because panel 3 and 4 are going to work together, the project team considered to connect both panels to support each other. Kim Golombisky and Rebecca Hagen (2010) stated that brochure layout works like a tour guide that welcomes visitors and leads them to be engaging from starting until finishing step (p.70). Therefore, contents in panel 3 and 4 were added to consider how reader can be more engaging to the information. We determined that reader should want to know more on native plants after they have known that rain garden needs native plants.

Figure 32: Examples of native plants in brochure

Therefore, we provided native plants with boom times as it is shown in figure 31. We adjusted the pictures of native plants examples that were added in the brochure to be the same size and style. This follows alignment principle. This native plants are below plant topic in the how to make a rain garden table because they are similar topics that helps reader to understand the brochure's structure and can look for information that

they need easier. This followed proximity principle that similar topic should be grouped close to each other. This helped organize brochure's contents.

Also, reader might have a question of cost and how they can maintain a rain garden. we added cost and how to maintain a rain garden were added below the table of how to make a rain garden as it is demonstrated in figure 33.

Figure 33: Example of cost and maintenance of a rain garden in brochure

According to the figure 33, we added a table of cost that had the similar colors the other text boxes. This followed repetition and makes the brochure looks unity. We added a large picture of beautiful rain garden to help persuade reader to build a rain garden. To add picture here followed alignment that helps avoid arbitrarily visuals and elements because it connect to the "maintain a rain garden" box below.

4.3.4 The Development of the 5th panel

The 5th panel emphasizes the call to make rain garden and provides complete answer for concerns question that the target audience might have. This part tells the reader that they should make a rain garden now. We needed to emphasize that we persuade reader to make a rain garden. Figure 34 shows design panel 5 of the brochure. We highlighted sentence, "ready to start?" to restate the action that they need to consider to accomplish after reading this brochure.

In this panel, the reader can also find answer for the concern question that they might have in this panel, such as how rain gardens survive in the winter, if rain gardens allow mosquito to grow, etc. According to the feedbacks on question connection that it was needed to improve, we tried to connect a question by answer from previous question. This helps reader to read through the brochure easily. In addition, at the end of this panel, the project team provided the link to the project's website, so reader can search for more information if they come up with more questions or want to know more about rain garden. By emphasizing on asking them to make a rain garden and having understandable answers, reader should feel more comfortable to start to make a rain garden.

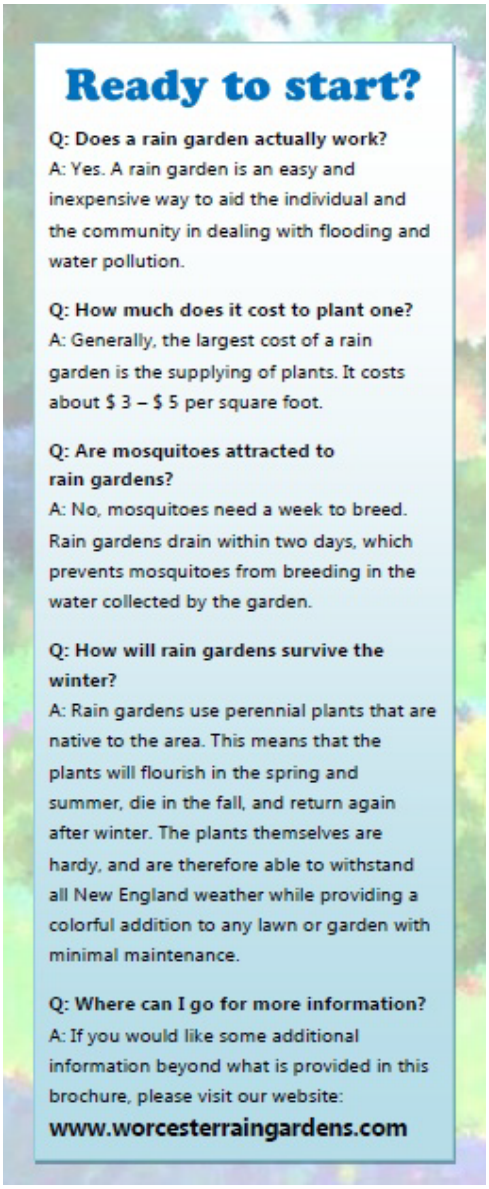


Figure 34: Panel 5 in final brochure

4.3.5 The Development of the 6th panel

Panel 6 provided useful resources and contact information. Figure 35 shows the 6th panel of brochure. We researched on resources that can support Worcester community on making a rain garden. Then, they were added in panel 6.

Figure 35: Panel 6 in final brochure

So, the reader or target audiences can contact or go to these websites to have more supports. In addition, at the end of this panel, the contact information that Worcester community can contact if they have more question. Most existing brochure materials guided the project team that the 6th panel should not have much detail information. Therefore, the brochure was ended with useful rain garden resources, contact information and logo.

4.4. Conclusion

The brochure was developed by following contents, layout, design principles and color strategies to accomplish it goal that will persuade Worcester communities to make rain gardens along with provide behavior change on environmental issues, especially flooding and water pollution in the Blackstone River. We develop the 3-fold brochure with 6 panels because it is most common. According to following four stages strategy of media development model that was adapted from chapter 3, DGAR: determine, generate, assess, and revise, we were able to create rain garden promotional brochure. Then, we made a revision according to the target audience focus groups' opinion. We have a final promotional brochure that is ready to distribute in the Worcester city in order to advertise and persuade them to want to make rain gardens. The brochure can distribute information quickly because it has a high accessibility. We created the brochure to help better distribute information of rain garden with simple and understandable provided knowledge. However, it does not focus much on the sewage

overflow problem in Worcester. So, we needed the other media that can support the brochure by highlighting more on the problem of flooding and water pollution in Worcester. Therefore, we created a promotional rain garden video that we are going to cover in the 5th chapter.

Chapter Five: Development of the Promotional Video

With this purpose of our project being the promotion of rain gardens as an alleviant to the effects of storm water run, creation of a promotional video was most appropriate. Through the research conducted during phone calls and interviews, it was found that many people do not know what a rain garden is so, the creation of a promotional video proved to be the more effective type of video to use to achieve the goals of our project. Both promotional videos and educational videos were explored to see which would be more effective for their use in our project. Educational videos are used to educate the viewer for the sole purpose of learning about a specific topic, while promotional videos provide information, and foster learning on a background for the sake of motivation.

5.1. Promotional Video Purpose

Our project is a process of designing effective promotional material with the aim of motivating action among members of our target audience. We aim to motivate them to make a difference in their community and emphasize the ability they have as individuals to make a contribution towards what seems like an insurmountable problem. This is particularly important because when talking about a problem, many times, people will attribute it to be addressed by a higher power or some municipality above their own. That belief is true, but to a small extent. While it is the combined sewer systems inability to handle extremely large quantities of water, homeowners are adding to this by directing their excess storm water down impervious surfaces where it picks up various pollutants and sediments. Additionally, it is this storm water runoff from individual homes that is also carried directly into local streams and ponds by the correct drains. This is just as damaging to the environment as the sewage overflows are. By showing the community the various things that can be done on the daily basis to effect change in the

environment, motivation to inspire change can occur on issues concerning storm water runoff issues.

The creation and use of a promotional video in this project is innovative for inspiring change in the Worcester and Central Massachusetts community. This video shows that rain gardens are an innovative alleviants to a reoccurring issue in the city of Worcester. Rain gardens are innovative because they make great use of resources in the community as an example of green infrastructure instead of gray infrastructure. They are also innovative because they are cost effective, easy to make, and are made of materials that are easily accessible to the community. Innovation is a key that has been used in this project to help distinguish this project apart from others that have already occurred relating to this same topic.

5.2. Video Design

Effective method of design for a video can directly affect the influence it will have with its target audience. In the designing of our video we considered effective methods of planning the creation and placement of themes, visuals and audio to help enhance the effect of the message delivered to the target audience. We considered multiple script formats and utilized one that allows us to document audio and visual characteristics of a video effectively.

The design of this video was inspired from a script design that was adapted from (Telg 2009). This method involves creating two columns, one column is for visual information that is represented and the other column is for the audio that accompanies it. Table 11 below presents an example of a two-column script (Telg, 2009). Our project utilized the idea of this script, but with the advice of one of our stakeholders, we were advised to add another column to represent time. This way we could more effectively create our video and have a time conscious method to gauge the length of certain aspects of the video to make it a more effective promotional item.

VIDEO	AUDIO
Fade up to on-screen text: "Starting a Successful Oil Collection Program"	Music fades up, then under narration
Dissolve to shot of oil well pumping.	NARRATOR: Oil. Black gold. Crude. Whatever you want to call it, it's changed our world.
Dissolve to shot underneath a car, oil dripping into drain pan.	
Cut to shot of traffic. Cut to plane taking off.	With it, millions of people can take to the roads or the skies for easy, quick travel.

Table 11: Example of two-column script

5.2.1. Design Choice

One of the design characteristics that gives strength to promotional media is its ability to be trusted and acknowledged. As mentioned by Boame, the video must be interactive and build trust with the members of the target audience. This is important because it increases the perception of value for what we are promoting and gives the audience the ability to foster a form or understanding and trust for what we are bringing forth. For this project, rain gardens need to be planted by members of our target audience by choice. The video will motivate them through our outreach to help create an ownership for the issue at hand. This ownership can only be created after a trust is formed with members of our target audience. Trust is formed through the delivering of our message and to show people the available resources to reduce the effects of storm water runoff and water pollution through the implementation of rain gardens. Overall this project is to lessen these effects for the extended comfort of the target audience, once this is understood, trust can form between the campaign and members of the community.

Lastly, Boame states that when creating outreach material for a specific group of people such as a video, it is important to get their input on the material you're using to communicate to

them. There are many ways to effectively gather input and communicate with members of your target audience. They can range from direct communication with members of your target audience or even surveys. For our project we were able to conduct phone calls and user interviews on our outreach material and about information relating to the project in general. We were able to address that members of our target audience knew very little about rain gardens unless they had already worked on a project with relation to storm water runoff or local environmental projects. With this in mind we were able to determine the content of our video. We needed to consider that most of our audience probably does not know about rain gardens as well as the storm water issues that we will be using to call them to action.

5.3. Video Content and Layout

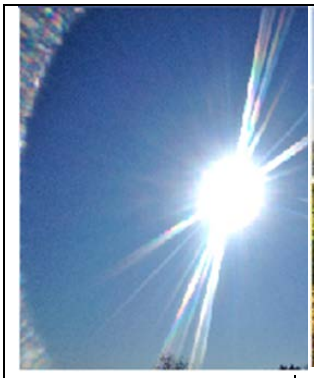
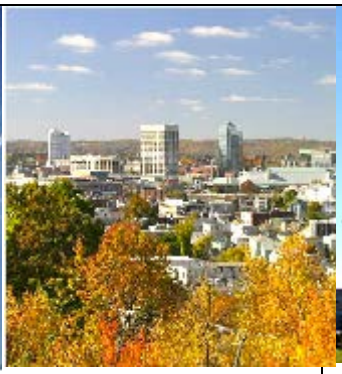
			
Located in the heart of Massachusetts, The city of Worcester is a vibrant and culturally diverse city. Our residents and visitors can boat on lake Quinsigamond, visit numerous world class museums attend cultural and entertainment events at one of our many theaters and our convention center. And it's a great place to live, offering residents' access to work in the exciting fields of healthcare and biotech industries a **solid** education system w/ international recognized universities and community activities, like farmers markets and art fairs.			

Table 12: Part 1 of video: Intro to Worcester

Introducing the location of the target audience at the beginning of media can give the viewer a stronger sense of understanding for who will be affected by the outreach. As stated in the article (Do-it-yourself promotional videos, in The American Salesmen, 1996), promotional

videos have been established to be a very efficient marketing tool. With this in mind if one is marketing a product, people need to have an instant understanding of whether the product is something that will be useful for them or not. With Worcester introduced at the beginning of this video it demonstrates who the video is reaching out to, as well as the location that change aims to effect through the form of rain gardens. Furthermore, depending on the type of media it also immediately acknowledges the location of need if there is any problem that needs to be alleviated or addressed. For instance, in our project, Worcester is the location that is suffering from the effects of storm water runoff, as well as other areas in central mass, and this section of the video helps to provide background information on the location before introducing the problem to the viewers, as well as provide a slow transition and adjustment to the breadth of the medium.

Presenting the Worcester in the introduction of the media helps to create a frame of reference as to how local the problem is. Many times when discussing problems that effect locations present around the country, for instance in (green infrastructure by McMahon E) in how he presents examples in Maryland, Minnesota and Illinois, members of the target audience can gain ownership of the effects of the issue. If they feel that others are also experiencing this problem they will just assume that they are powerless to do anything about their situation. By presenting Worcester in the introduction, it can create a form of recognition, as well as ownership to the problem at hand. If members of our target audience feel ownership to the problems in Worcester or even at least a connection, it can be utilized to foster motivation to want to do something about these problems. The visual presentation of Worcester in the introduction of this video aims to achieve that objective.

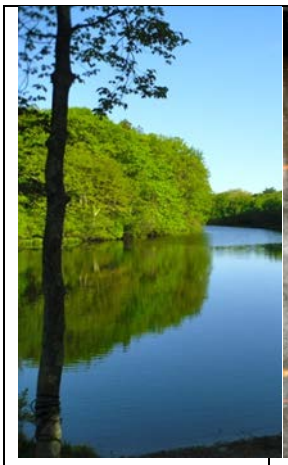
 		 		
However Worcester faces a number of environmental challenges due to the effects of excess storm water runoff	The excessive water in the streets can make mobility very difficult while in the city. The roads and sidewalks are impassable and dangerous	Because the city of Worcester sits on top seven hills, when it rains excessive water tends to accumulate in low-lying areas. Thus the city has to deal with flooding and water pollution issues on a regular basis. This taxes the city and its resident's money and its resources damage caused by the water.	For example replacing existing storm water pipes is one approach to lessening the problem. However, this is not a permanent solution since the amount of rain water runoff continues to rise over the years. Replacing the pipes also requires a significant investment from the city's budget while introducing the urban inconveniences of construction, such as traffic detours congested traffic and excessive noise.	

Table 13:Part 2 of video: Storm water flooding problems in Worcester

In order for a video to be effective in promoting its message it needs to follow specific criterion to properly address its target audience. Adapted from (Developing promotional material by Ecominds(2011) it states that when developing promotional material you should try to achieve the following Attention, Interest, Desire and Action. When promotional material is first viewed it should attract attention so that people will want to read or watch further. In our video we created a script that introduces the city of Worcester as a location of focus for the video and then jump right into the problem.

After the introduction of the medium, transitioning into the problem at hand can effectively create a smooth shift to educating our demographic about the problem as well as preparing for the resolution. As stated by Carlton and Blaise (2004) there are four factors that are characteristic of a successful promotion, specifically for this example effective marketing message. They go on to explicate that many times the product will only explain the logo without a strong statement of how it benefits, or even a call to action, and how it can have an adverse result on the entire project. The relevance of this information to our IQP is by slowly presenting all the aspects of the problem after the introduction it creates a segway for our call to action. It creates a clean layout of introducing the location, some background on its significance, the issues that it's currently facing. Through that sequence of topic in this medium it creates a desirable opportunity to open up into our resolution, and the methods of alleviating storm water runoff through rain gardens.

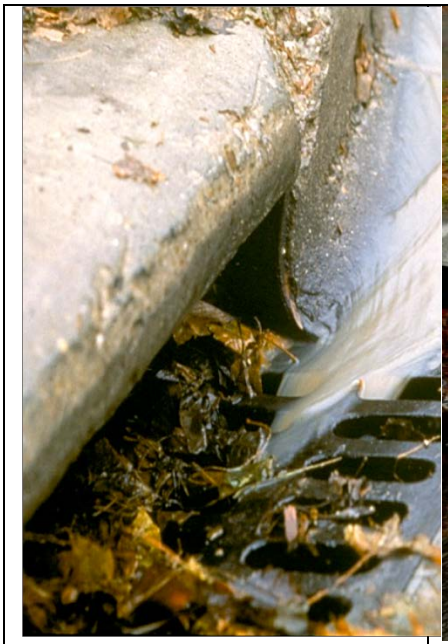
The topics that create the segway into the call to action are the topics of flooding due to storm water runoff. These topics are demonstrated in this section of the story board through the presenting of a gutter being overwhelmed with water, a flooded basement and an example of road construction. These pictures are presented in this fashion to present the message we are

trying to deliver concerning the types of hindrances storm water runoff creates for citizens in Worcester. The gutter photo gives the effect of how extensive the amount of storm water can be, as well as the picture of the flooded basement to help show the negative impact it has on families concerning the damage to their homes. Furthermore the picture of road work is representative of the inconveniences that can be caused financially by trying to alleviate the issues due to storm water.

By doing this we are able to effectively attract the attention of the target audience by directing them to the severity of the problems affecting their community. Another criterion that should be achieved when developing promotional material is Interest. After successfully capturing the viewer's attention you need to hold their interest, this can be done by further engaging them, Ecominds(2011). In our video the method of further engagement takes place in the immediate presenting of additional material to divulge further into the problem at hand. An example of this takes place between the smooth shift from flood issues to pollution issues caused by storm water runoff.


Furthermore, during periods of heavy rain fall, the sewage treatment plants cannot handle all the sewage and the excessive storm water runoff. This water and sewage is then dumped into the

black stone river, in effect polluting our local water ways




Non-point source pollution is also a problem affecting Worcester waterways. Pesticides, fertilizers and chemicals mixing in into the storm water create additional opportunities for contamination. These factors, although not very publicized, can also pollute the storm water as well as create more work for the treatment plant through water purification.

Although these problems seem very difficult to deal with, there is a way to make an individual difference and lessen the effects of pollution here in the city. Rain Gardens.

Table 14: Part 3 of video: storm water problems in Worcester

For this project interest is held by focusing on how these problems affect the local community. Further, with this in mind members of our target audience can realize that this problem is real and local, bringing more attention to the issues and holding their interest. Next criterion is desire, you need to create a want, motivate them to help or take part in what you are promoting, Ecominds(2011).

After showing members of our target audience the problems and issues that occur in the city of Worcester relating to storm water runoff we present the method of managing this issue and push the idea of their ability to take part in it. Through this we hope to create a desire in them, to motivate a want to make a difference in the community, after knowing the effects of storm water runoff and how there is a way to do something about it. The fourth criterion that should be addressed in the development of promotional material is Action, Ecominds (2011). After reading or viewing the outreach material we should make it clear what we want them to do, how they can do it, and who they should contact if they have any issues trying to do it, Ecominds (2011).

This section of the video provides an additional segway to effectively justify the need for an alleviant, preparing the audience for presenting of rain gardens. This section of the video utilizes the pictures of the Sewage Treatment plant to emphasis the effects of how storm water influences pollution in the city of Worcester. As well as pictures of Gardening supplies and bottles to represent non-point source pollution as an additional manner of pollution that occurs through storm water runoff. Pictures of storm drains are presented to help bring the viewer back

to a local feel through the labeling of local waterways as a destination for the contaminated storm water, as well as bringing the feel of the insurmountable problem home.

Worcester Rain Gardens
• Rain gardens are a method that anyone in the community has the power to do. • As long as you have some land, plants and time, you can make a difference in the community and the problems that affect it. • They can immediately address the flooding issues. • Purify water and stop it before it reaches homes, apartments, roads and storm drains. • Rain Gardens use native perennial plants, and shrubs. Here are some examples of some plants you may find in a rain garden:

Table 15: Part 4 of video: rain gardens, their benefits and purpose

According to Boame, a characteristic of a highly effective medium is that it is well branded. This video features a logo that was created for specific use with rain gardens in the city of Worcester. This logo helps the members of the target audience associate all the forms of outreach created for this project to each other. It helps them easily identify that all components of this project are working together to deliver the intended message sent forth in this video.

After the effective knowledge of the problem is present amongst members of the target audience, a resolution can be properly brought forth in that particular form of media. According to Carlton and Blaise (2004) emphasis on the topic of timing is discussed, explaining that timing can affect the outcome of the end result of the entire project. This particular point reignites in our project because the introduction and the background on storm water pollution and the combined sewer system laid the ground work for rain gardens as a method to assuage the problem. In this rain gardens project, our outreach as the purpose of educating our target audience on the effects of storm water and promoting rain gardens as an effective method of management of these issues.

Our outreach in the form of a video prompts the members of our target audience to take action through the multiple examples in the video of rain garden benefits, feasibility and ease of

installation on their own residential property. In the development of promotional material structure, the follow factors need to be considered, who, what, where, when, why, and background, Ecominds(2011) . When considering all the factors of our project we were able to effectively answer the five W's, those being home owners in Worcester, specifically groups interested in community or environmental sustainability as shown through their membership in neighborhood organizations and c.d.c's. As well the campaign taking part in Worcester M.A. and other areas in Central Massachusetts that are affected by this issue. When is now, at this current time, as well as the history of this problem throughout the years. Why, is to alleviate the effects of storm water runoff. But our project is unique because through data collection we realized that we had to take special consideration into the background section for creating promotional videos. When members of our target audience knew nothing of the product we were trying to present we realized we also had to consider educational factors into the final deliverables of our project.

Table 16: Sequence of flowers

Rain gardens through their bright colors and enriching appeal create a strong motivating shift from the gloomy problem in Worcester to a bright hopeful resolution for the future. This shift was effectively created with the clever use of our logo to represent the change in tone, as well as presenting our logo with rain gardens,. After presenting the series of rain gardens we staged a section of the video to present a number of flowers that would be found in a rain garden, we aimed that through the variety of colors that the flowers bring we can continue to hold the interest of the viewer from the aesthetic perspective of what a rain garden can be. The ending of

the video brings back the capabilities of individuals to make an effort to address an insurmountable problem.


Rain gardens are a method that anyone in the community has the power to do. As long as you have some land, plants and time, you can make a difference in the community and the problems that affect it. Rain gardens are a step towards effectively handling storm water. A step towards creating a cleaner water shed, Helping Central Massachusetts move towards a swimmable fishable Blackstone River.

Table 17: Part 5 of video: resolution

Adapting the findings of other promotional and environmental campaigns has been helpful for our project for example charity water. Charity water is an organization that has a focus of raising money for the efforts of providing clean water for anyone and everyone in the world who doesn't have it. They use many techniques through their outreach and their message to motivate people to give money to help make a difference. (http://www.charitywater.org/) Charity water has been particularly helpful because its videos have been great examples of promotional videos that motivate people to take action while providing enough information on the problem they are trying to address.

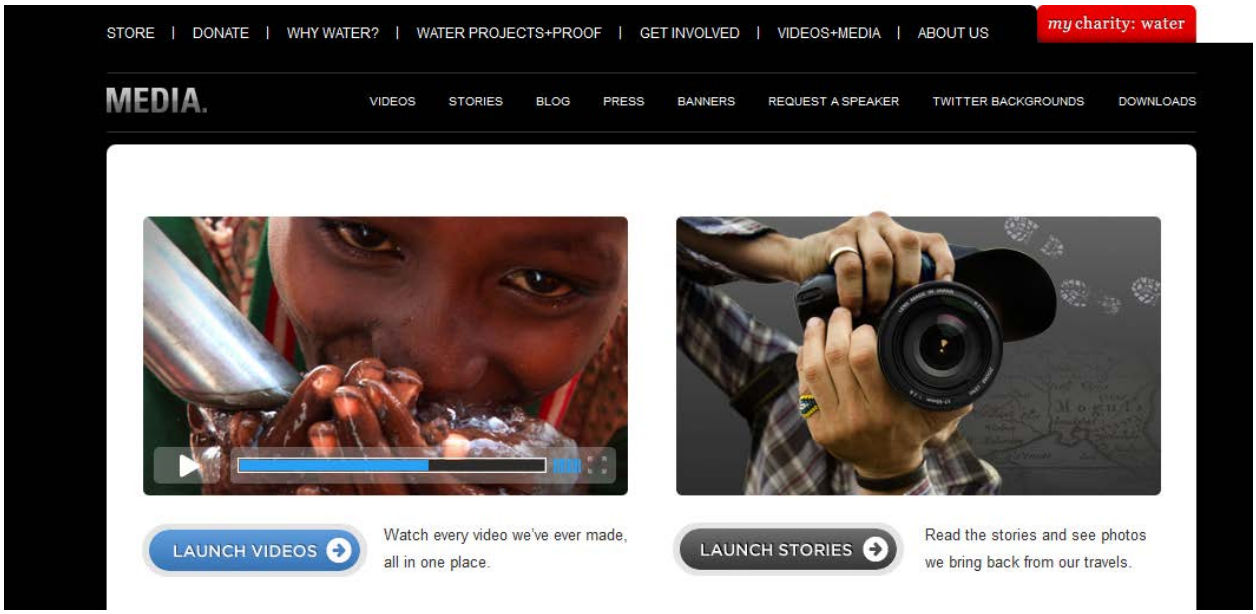


Figure 36: Charity Water Website

In the screen shot above charity water uses two forms of video media in order to promote their campaign for clean water. Its uses campaign trailers that are recorded once a year since the founding of this non-profit organization, as well as a video that shows the purpose of their organization and the change they hope to make in providing clean water worldwide. Through the yearly campaign videos, Charity water is able to keep people engaged and motivated to donate money to make a difference. As stated by Ecominds(2011), for those who are not aware of the problem of the lack of clean water to underdeveloped countries worldwide, they created a separate video that acts as a background section. This background section, is a key structure in any promotional video or media because it acts as a segway that brings members of the target audience to the product that's being promoted, it provides the need for the promoted product, Ecominds(2011) . Charity water is a great example of media in relation to our project in that is promoting an environmental aid to an ongoing environmental problem, Charity water as been able to successfully fund 4,282 projects, provide clean water to 2,060,000 people in 19 different countries. (charitywater.org) through our project, we hope to utilize our outreach, especially the

strengths of our video as a way to visually represent our project, our goals and how we hope to achieve change in the community.

The effectiveness of our video is dependent on how people choose to receive our message. The message of the adverse effects of storm water on the Worcester community with respect to flooding and pollution as well as whether they choose to accept rain gardens as a method to make a difference and combat these effects. By utilizing practices done by other environmental and promotional campaigns, we've been able to create a video that follows a specific format based on structures of background education on the location, on the problem and a possible resolution. Working with the other forms of outreach being a brochure and a website we hope to utilize all three effectively to motivate change and make a difference in the Worcester and central Massachusetts area.

Chapter Six: Development of the Worcester Rain Gardens Website

The aim of our website is to provide home owners in Worcester and Central Massachusetts with more detailed information that would convince them of making a rain garden and also to provide them with a way for gathering the necessary resources for making a rain garden. As mentioned in Chapter 3, a website has less of a limitation than a brochure and a video for the amount of information it can transmit to the audience. For this reason, the website can provide stronger evidence that needs a more elaborate explanation for why rain gardens are a relevant infrastructure to be implemented in the city of Worcester. It can also provide a more ample catalogue of local resources so that visitors can more quickly and easily start making rain gardens in their own homes.

The key component that was taken into consideration in the creation of this promotional material was the usability of the website. In this chapter, we will highlight four major aspects of our website which have an impact on usability, and these are: navigation, layout, content and aesthetics. Layout and navigation must support each other so that users may intuitively find the information they are looking for without any inconvenience. Content and aesthetics must be in harmony so that there is coherence in the information being transmitted and so that users may clearly understand the message. The first two we will discuss separately and the last two we will discuss in relation to specific pages in the website.

6.1 Navigation

One of the features of online content is that any one piece of information can be linked to many other relevant pieces of information without specifying any particular order. This lack of linearity, however, can lead to confusion, as Bertrand Gervais (1998) from the University of Quebec explains by comparing hypertexts to labyrinths (p. 28We had to give careful thought to

organizing the information on the website with the aim of giving users a system that allows them to easily browse the content of the site. This also relates to the website's layout, through which users attempt to intuitively search for what they are looking for.

6.1.1 The Site Map

The first step in the creation of our website was to develop a site map because it sets a foundation around which everything else can be constructed. As stated by Wotke and Govella (2009) in their book *Information Architecture: Blueprints for the Web*, a site map serves to document the pages of a site and the interaction between them (p. 171). This allows us to visualize how the information will be laid out and how users will be able to access it. Wotke and Govella suggest having one primary task per page (p. 164). Therefore, we made a judgment on what information serves in accomplishing one particular task so that we could then keep separate tasks on different pages make sure that we had enough information for completing each particular task.

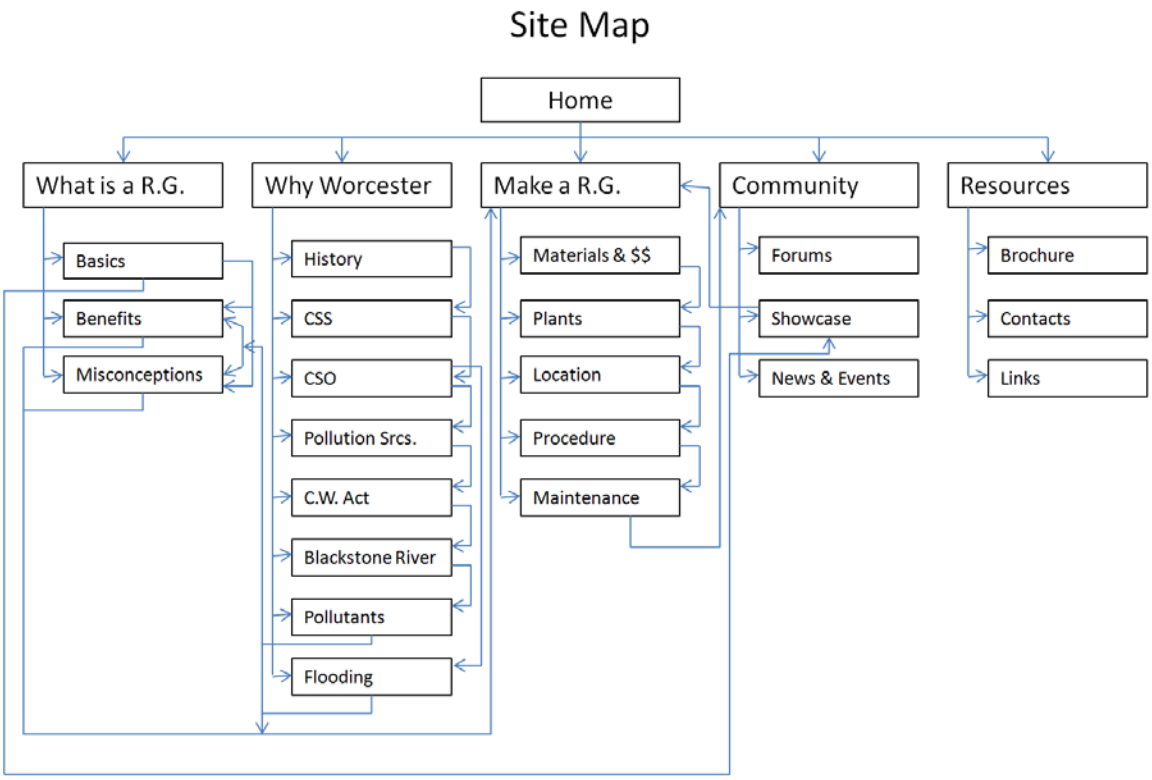


Figure 37: Site map for www.worcesterraingardens.com

We organized the sections of the website according to the tasks that users will be able to accomplish. These tasks are: learn the basics of rain gardens, learn why rain gardens are relevant to the city of Worcester, learn how to build a rain garden and share with other the experience with making a rain garden. These sections can be seen Figure 37 and they are labeled ‘What is a R.G.’, ‘Why Worcester’, ‘Make One’, ‘Resources’ and ‘Community’ respectively. These five sections encapsulate each of the primary tasks that we want our users to be able to accomplish and they reflect the steps needed to fulfill the aim of the website as mentioned in the introduction of this chapter.

We chose the tasks that form the structure of our website to fulfill a need in our outreach efforts that is not satisfied by the the video or the brochure. As discussed earlier, the website allows us to provide homeowners who have access to the internet with more detailed information

than with the space constrained brochure and the time limited video. However, the website must stand by itself in making a convincing argument for building rain gardens in Worcester. The logical sequence that covers all the content of our website begins with an explanation of what a rain garden is, and this is because visitors will not respond to the call to action of building a rain garden before having a basic understanding of rain gardens. Although the first section covers some of the benefits of rain gardens, which gives visitors some reasons for making one, it does not show the local need for rain gardens and, therefore, the second section in or website elaborates on the issues that the city of Worcester is facing and highlights the importance of the call to action. Now that visitors have been given personal and communal reasons for making a rain garden, they should be ready to make their individual response to the call to action and so the third section of the website goes into the details for making a rain garden. During the process of building their own rain garden, visitors might encounter the need to find resources or ask for expert help, and we take care of this by providing a 'Resources' section. The 'Community' section also provides visitors with a way for asking for help, but it also offers a way for users to stay connected with one another through the website even after they have already fulfilled the call to action. Since websites are not a linear medium, separating the content into those sections allows for users with different needs to approach the website through any of the steps in the process.

The links on each page, as shown by the arrows in Figure 37, are included so that while users are on that particular page they might continue to the next step in their current task. As Gehrke and Turban (1999) suggest, internal links should take precedence over external links (p. 6). This means that we should not include links on our pages to other websites unless necessary so that users may be able to complete the task they were working on before being taken

somewhere else. If external links are to be included, they should come at a logical point in the user's task. In the case of our website, external links are only included in the pages for contacts, resources and credits (not shown in our site map).

Another consideration given for keeping users in their current task was to give users different options on a single page for what their next step could be. Wodtke and Govella claim that this facilitates a user's tasks, but that priorities must be given to the different options so that only the most important are included (p. 178). The different options given to the site's visitors can be seen in Figure 37, where a single page points to many different pages. Consider the instance of a visitor who is more interested in learning of the relevance of rain gardens to the city of Worcester, who might first read about the difficulty for combined sewer systems to handle large quantities of rain water runoff and then move on to learn that one of the benefits of rain gardens is that they allow water to pool and prevents it from entering into the storm drains. Therefore, having links on a single page to various, but relevant, other pages aids users who might have a different idea on what steps constitute any given task and in which order they might be taken.

Since the ultimate goal of our website is to get visitors to build a rain garden, many of the possible chain of links that can be taken end on the 'How to Make' section. By looking at other pages of non-profit organizations, we found that they also structured their websites around a particular purpose. Many pages on the One.org website contain links to various articles on the 'Issues' section of their site, showing that their main intention is to inform visitors on various subjects. On the other hand, TakeTheWalk.net focuses on getting people involved in various campaigns, so almost all of their pages contain very few links and highlight the ways in which users can commit to their causes. Similarly to these other sites, the links in our website attempt to

steer visitors towards a particular direction. All other sections, except for ‘Resources’, point to the ‘How to Make’ section (see Figure 37). No matter what particular objective our users try to accomplish, it is always possible for them to end in the ‘How to Make’ section, so they can, at the very least, get an idea of what goes into making a rain garden.

6.1.2 Main and Secondary Navigation

The most important tool for allowing users to find information is the global navigation of the website. Global navigation gives users access to anywhere else on the site, say Wodtke and Govella, no matter on what page they currently are (p.193). On our website, the global navigation takes the form of a horizontal menu bar (Figure 38).

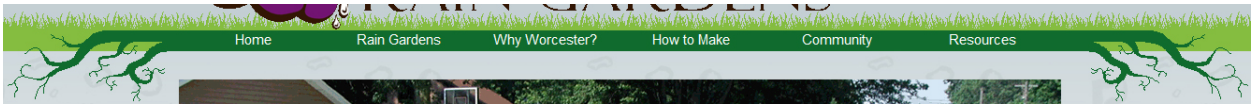


Figure 38: Main menu of www.worcesterraingardens.com

The first level of this menu contains the main sections mentioned in Section 6.1.1, plus an added link to the home page. The drop-down menus under each option contain direct links to all of the other pages of the website. From any page that the users might be in, they have the option of jumping to anywhere else on the site. For example, the user who first learns that rain gardens are designed to hold water might be curious about how this is achieved and through the main navigation is able to jump to the description of soil composition. The main navigation is always available to help users if either they get lost or if they decide to start working on a different task.

The main menu of our website can also serve as a quick overview of all the content in the site. The second, but perhaps more important, purpose that Wotdke and Govella mention for the global navigation is to give visitors an idea of what the website is all about and what they should use it for (p. 193). This means that the names of each element in the menu must be reflective of the content on the page they link to. Furthermore, providing users with an overview of the

website's content is a good idea because it allows them to easily determine which sections are particularly interesting to them and they can focus on gathering the information that they consider to be relevant for their purposes.

The secondary navigation of our website consists mainly of a side bar to the right of a page's content (Figure 39).

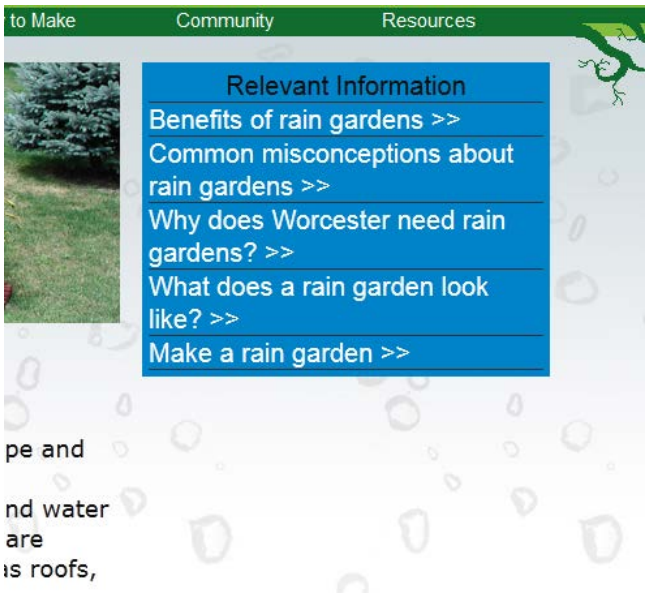


Figure 39: Side bar with relevant links of information

This is not the local navigation of a section but rather it links to relevant information coherent with a user's task, as mentioned in section 6.1.1. The explicit local navigation, which allows users to traverse the pages of a particular section, is the drop-down menus of the main menu. However, the side bar that is found on most pages also links to other pages in the same section, so it can be used as local navigation with certain limitations.

6.2 Layout

Having established the underlying structure of our website, we then continue to organizing the visual interface that allows users to effectively browse the information on the site. Michael Bernard (2000) reports, in a newsletter from the Software Usability Research

Laboratory, that for a website to be more learnable its layout should be intuitive. That was the aim we had in mind when we design the layout of our website. In this section we will go over the reason for why the pages in our website are organized as they are.

We placed each element of our page so as to make it intuitive for our users to locate what they are looking for (Figure 40).

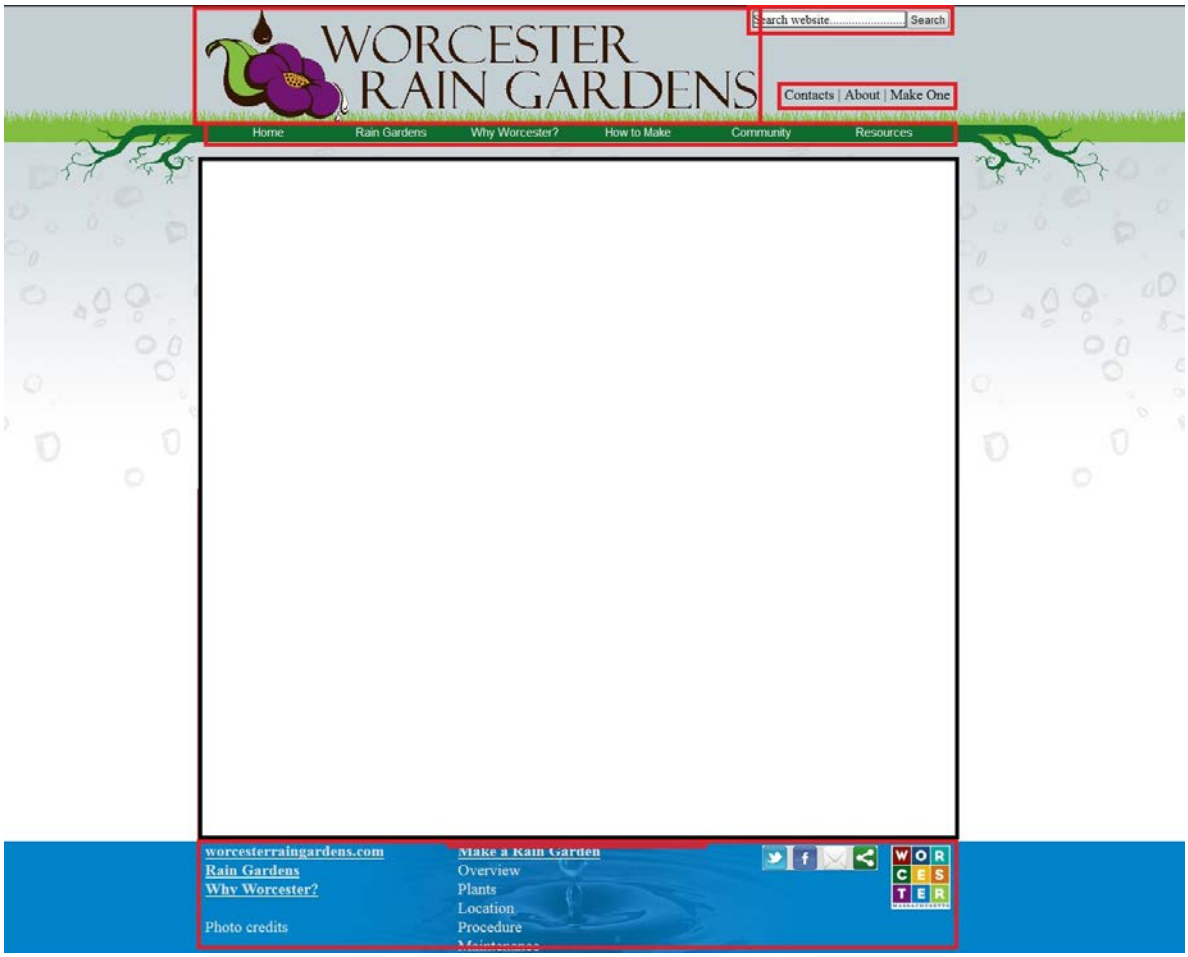


Figure 40: General Layout of www.worcesterraingardens.com

We placed our logo on the top left corner of the page next to the name of the website and a search bar and utilities menu on the top right corner of the page. Right below these we placed the main menu, and at the bottom of the page we have the footer. Looking at the different websites

in Figure 41 it is also evident that they follow similar practices in the placement of the elements on the page.

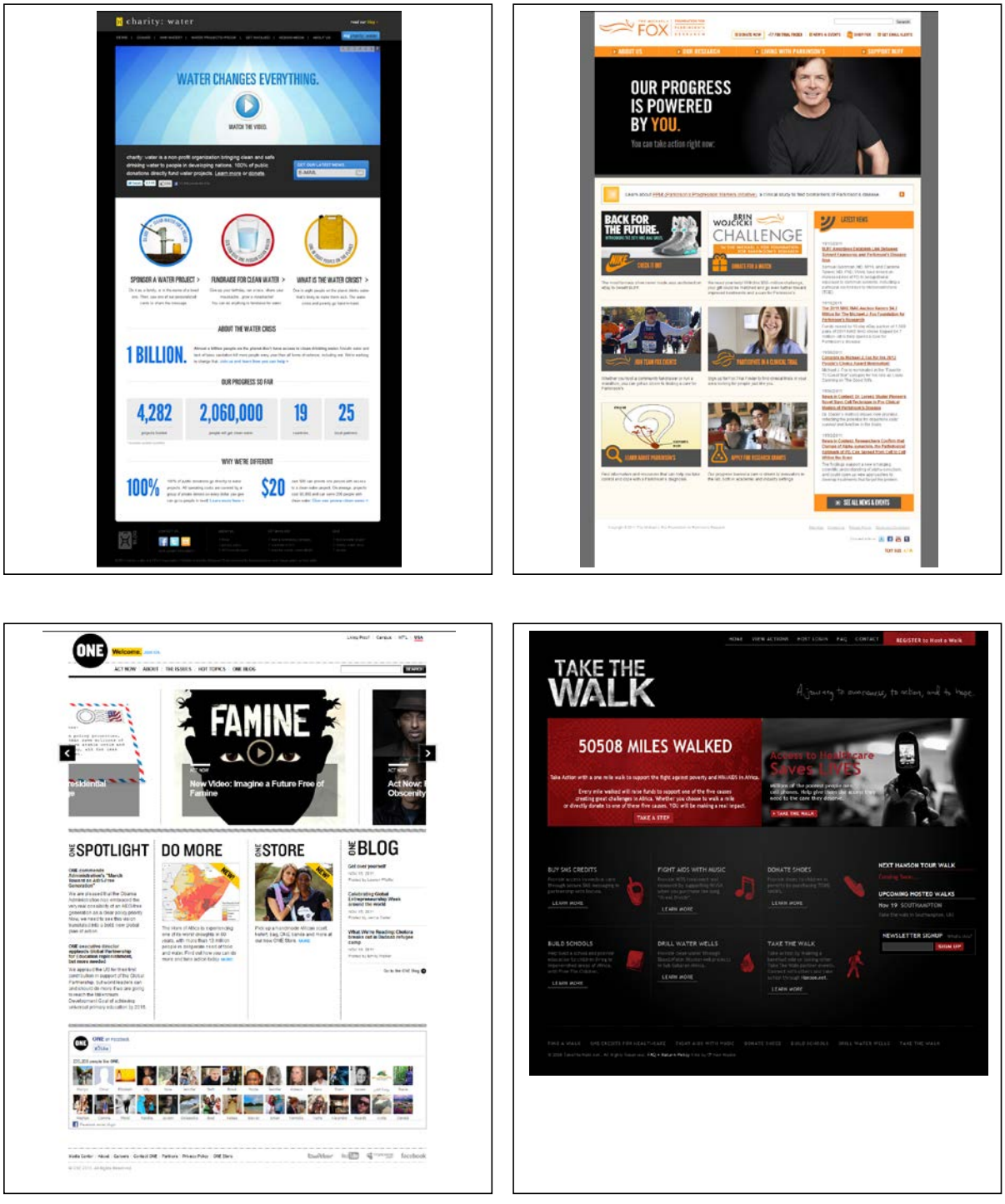


Figure 41: Home pages of similar websites

Their placement for the logo, name, utilities, search bar, main menu and footer is very similar. By following the same patterns as these websites, we take advantage of the layout that users are already accustomed to.

For the main menu we decided to use a horizontal navigation bar, which allowed us to allocate valuable space to more important information. The other websites in Figure 41 also used a horizontal navigation bar, except for TakeTheWalk.net which took a different approach to the navigation. Nielsen (2006) explains that when users scan a new page they tend to follow an 'F' shape. By not having a vertical menu on the left side of the screen and by letting important information occupy that place instead, we increase the likelihood that the information will be noticed.

The layout of the website must not only be intuitive but it should also be consistent. Morville and Rosenfeld (2006) state that the global navigation of a site is meant to be present in every single page (p. 122). Figure 40 shows a blank page of our website and it includes the global navigation which remains consistent in every page throughout the site. Steve Krug (2000) mentions in his book about usability, *Don't Make Me Think!*, that having the global navigation be consistent through the website gives reassurance to the users that they are still in the same site (p. 62). Every page in our website has the layout shown in Figure 40 and only within the white box does the layout change, depending on the content.

One of the underlying principles that was of aid to us in placing elements in an effective manner on our pages was a grid system. Shannon Noack (2010) defines a grid as the division of a layout with vertical and/or horizontal guidelines to incorporate margins, spaces and columns in order to provide a framework for organizing content. This is a practice that has been inherited from print designs and it ensures the alignment of elements in the page. All of the pages in

Figure 41, except for CharityWater.org, use a grid system and line up all elements neatly with one another. Alignment helps establish relationships between the elements, keep things organized and maintain the visual appeal of our site, as Robin Williams discusses in chapter 3 of her *Non-Designer's Design Book.* As long as the grid is always considered, items on the page should be kept in alignment without being given much thought.

The grid in our website has a width of 960 pixels with a division of three columns at the most to ensure compatibility across different computer screen and support usability. Most computer screens have a width greater than 960 pixels, which means that by having all elements fit in this space we are increasing the chances of avoiding side scrolling. All of the websites shown in Figure 41 keep their content within a similar width. These websites also tend to have a three column division, except for TakeTheWalk.net and, in certain cases, One.org which go up to a four column division. However, we limited our divisions to three columns to enforce simplicity and ensure that each element can be easily read.

6.3 Content and Aesthetics

The two main characteristics of our website whose purpose is to transmit information are the site's content and the site's aesthetics. These two characteristics play an important role in the site's usability. In their book *Balanced Website Design*, Lawrence and Tavakol (2007) suggest that a website's usability and aesthetics mutually impact on another (p. 66). The content contains the actual information that is being transmitted while the aesthetic aspects of the website highlight and expand on the content in a different representational form. In this section we will discuss the content and aesthetics of our website in relation to three different styles of pages that were used. But first, we will discuss details that are applicable throughout every page.

The content of our website is always determined by the tasks specified in section 6.1.1. The content of the home page is the starting points of the different tasks that can be accomplished in the site, and the content in each individual page is a part of a single step in accomplishing a particular task. Any page that contained information that did not contribute to any of the given tasks was not included in the website.

As a supplement to the website's content, aesthetics play an important role in the usability of our website. As mentioned in the introduction to this section, Lawrence and Tavakol discuss how aesthetics and usability are interrelated and inseparable. For this reason we underscored the natural theme of rain gardens with organic shapes in our website (see Figure 42).

Figure 42: www.worcesterraingardens.com's home page. The arrows point to the aesthetic details

We tried to reduce the number of shapes with hard edges and tried to match them with forms more commonly found in nature. For example, the sides of the box that contain the main menu

were expanded with graphics that resemble roots. We also included a water motif on the background and on the footer of the page. We felt this was appropriate for helping users understand the natural beauty and environmental benefits of rain gardens rather than focusing on the negative images of flooding and water pollution. This is most effective for encouraging visitors to build a rain garden in their homes since it reinforces the idea that there is a way to overcoming a problem that otherwise would seem to tough to tackle.

An important consideration that was taken when deciding the look of our website was the perception of our target audience because it helps predict the level of engagement from certain specific groups. Just by looking at a single criterion, such as the gender of the user, it is clear that different groups of people possess different preferences. There are distinct aesthetic preference between males and females, as discussed by Moss, Gunn and Heller (2006) in the *Journal of Consumer Behavior* (p. 328-341). Since our target audience consists primarily of women we tried to avoid colors that were too dark and serious but we also limited the use of pastels and colors that were too light as not to exclude men from our general audience and we avoided prominent floral patterns. We used blue and green to represent the themes of water and plants, and white for simplicity and cleanliness. By appealing more to one group than another, we increase the likelihood of raising the interest of women, who are more likely to relate to the subject of rain gardens in the first place, while also leaving open the possibility of engaging men with the message of our website.

6.3.1 The Home Page

The content on the home page of our website serves the purpose of directing visitors to the sections they need to go to in order to accomplish any one of the given tasks mentioned in Section 6.1.1. In the home page of our website seen in Figure 43, we provide visitors access to specific tasks.

Figure 43:worcesterraingardens.com 's home page. Main tasks are highlighted in red. Secondary tasks are highlighted in orange.

These links are for learning the basics of rain gardens, learning the local relevance of rain gardens and learning the details of making a rain garden. These three tasks take precedence over all others so they are displayed on the home page and contain distinctive graphics that help users anticipate the nature of their content. Other single-purpose community based websites we

looked at briefly explained the main purpose of the website in their home page, and they also made it easy for their users to access the main tasks that can be accomplished in the website. For example, in Figure 44 BackYardChickens.com has three bullets in the home page to direct users to three specific tasks.

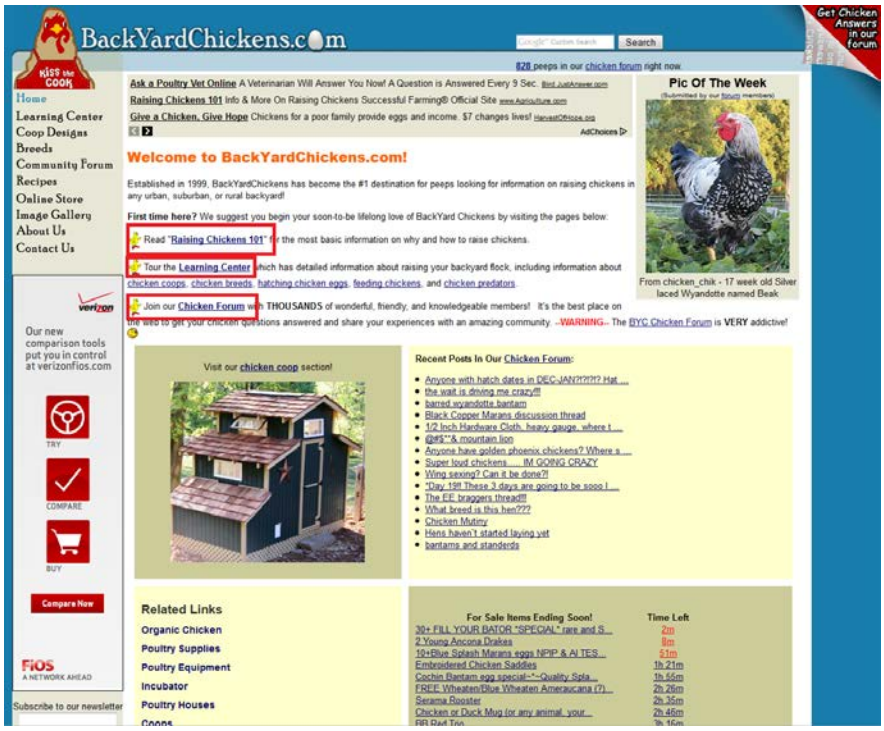


Figure 44:BackYardChickens.com 's home page. Bullets are enclosed in a red box.

These bullets are for learning the basics of raising chickens, getting detailed information on how to raise chickens and joining a community forum to share the experiences of raising chickens. These also provide users with quick access to the most important tasks they can accomplish in the site.

The home page of our website also has a large image with a short message towards the top of the page (see Figure 43) to allow visitors, at a glance, to anticipate the content of the rest of the website. All of the websites in Figure 41 also include large graphics at the top of the page with a brief sentence or two superimposed on the image. The purpose for this image is to catch

the user's attention and, in union with the text, to give visitors an idea of what the website is about.

6.3.2 The Informational Page

The content on a regular page of information in our website has a small header picture on the top left, the information under it and a side bar with links on the right side of the page, as seen in Figure 45, to take advantage of the most valuable regions on the screen.

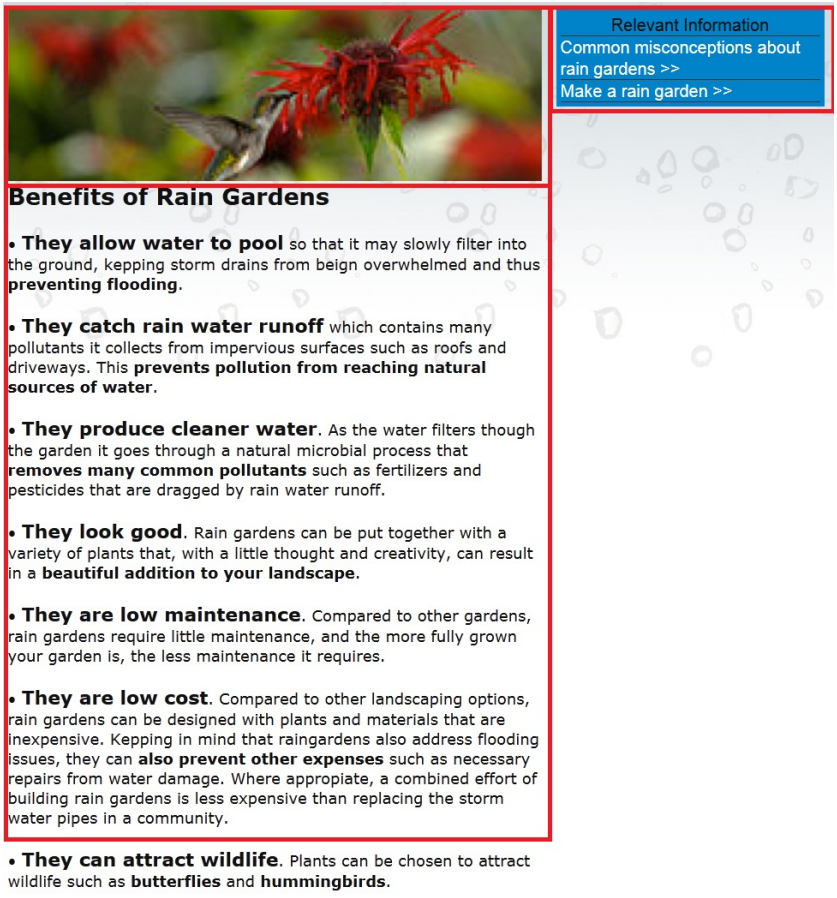


Figure 45:Example content page of www.worcesterraingardens.com

Nielsen (2010a) reports in one of his studies that in cultures where people read from left to right users spend 69% of their time looking at the left side of the page. Therefore, keeping the information on the left side of the page increases the likelihood that it will be paid attention to

the most. The side bar with links is immediately to the right of the information so that after users finish looking at the information on the left they might notice the list of links on the right.

In order to effectively encourage homeowners to build rain gardens in the city of Worcester, we repeat informational content from both the brochure and the video within the context of our website. The informational sections of our website are ‘Rain Gardens’ and ‘Why Worcester?’. The first informational section, ‘Rain Gardens’, discusses similar content as that of the brochure. However, in the website explanations and definitions are elaborated upon and there are clear demarcations between the basics of rain gardens, their benefits and common misconceptions about them. The second informational section, ‘Why Worcester?’, repeats the arguments made in the video that address the flooding and water pollution issues of the city. The language used in the website for this section is more formal and descriptive than that used in the video. By doing this, we rely on the advantages of each medium, in this case using the website for transmitting descriptive information that is meant to be remembered.

The information in our website is short and to the point so that visitors will be more likely to remember it. In his book dealing with website usability, Steve Krug suggests taking the information of each page, cutting it in half and then doing the same with what remains (p. 45). In Figure 45, the information consists of bullet points with no more than two sentences. This aims to illustrate that the information on a webpage should not contain anything that is not absolutely necessary to get the point across to the visitors.

Going a step further, we organized the information on our page so that it is easy to scan. According to Nielsen (2010b), web users would rather scan the content of a page rather than read it. Therefore, we anticipated this behavior in our users and made sure to highlight the main points of our information so that they might catch a glimpse of it while scanning. Peter Conradie (2008)

suggests establishing a clear hierarchy in the webpage's content (p. 16). We did this by showing clear visual differences between titles and subtitles and by also bolding the most important words in each paragraph (see Figure 46).

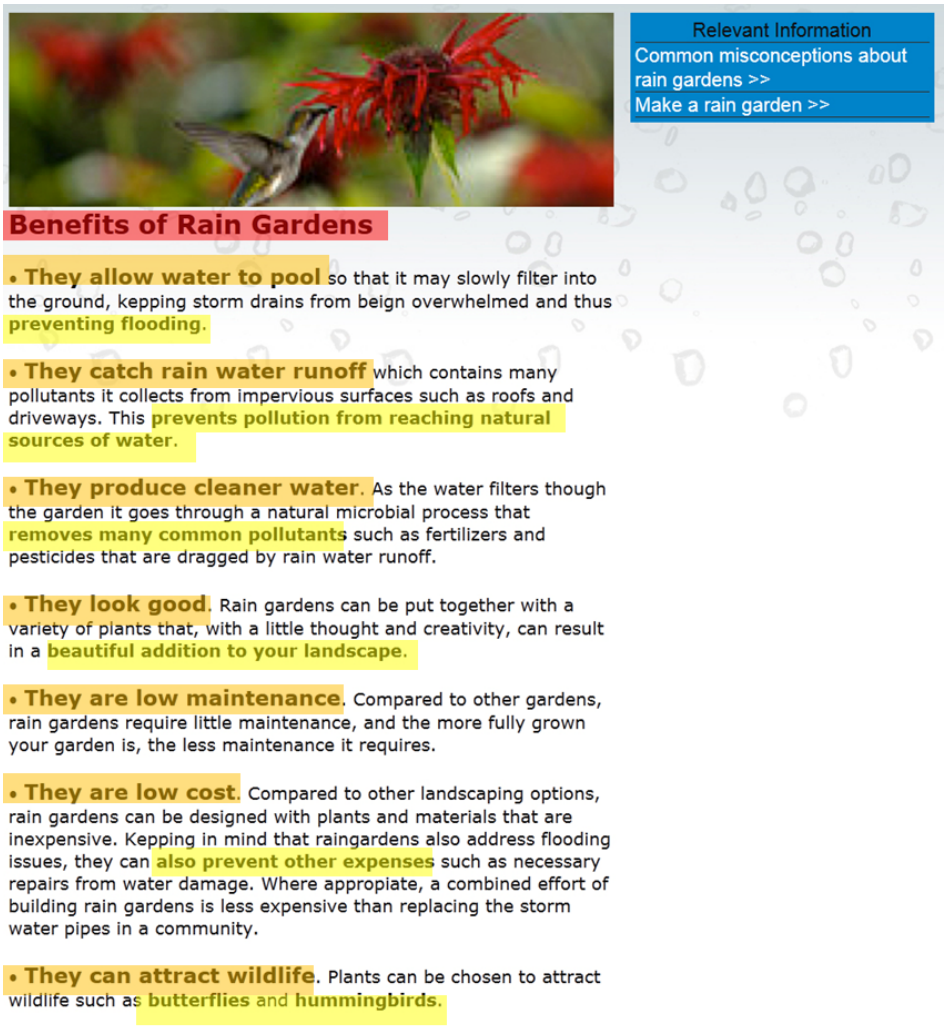


Figure 46:Content hierarchy. Text highlighted in red is the page's titles. Text highlighted in orange is the main point of each bullet. Text highlighted in yellow is important details.

By showing a clear hierarchy in the content, it becomes easier for the users to identify and to remember the important pieces of information within the pages of our website.

6.3.3 The Instructional Page

The instructional section of our website is the most sequential of all the sections because it describes a procedure. The steps for making a rain garden must be taken in a certain order for the final product to be what is intended. The content on each page is not only organized by each step in the procedure, but each page in the section represents a step in the procedure. A feature that helps illustrate this is seen in Figure 47.

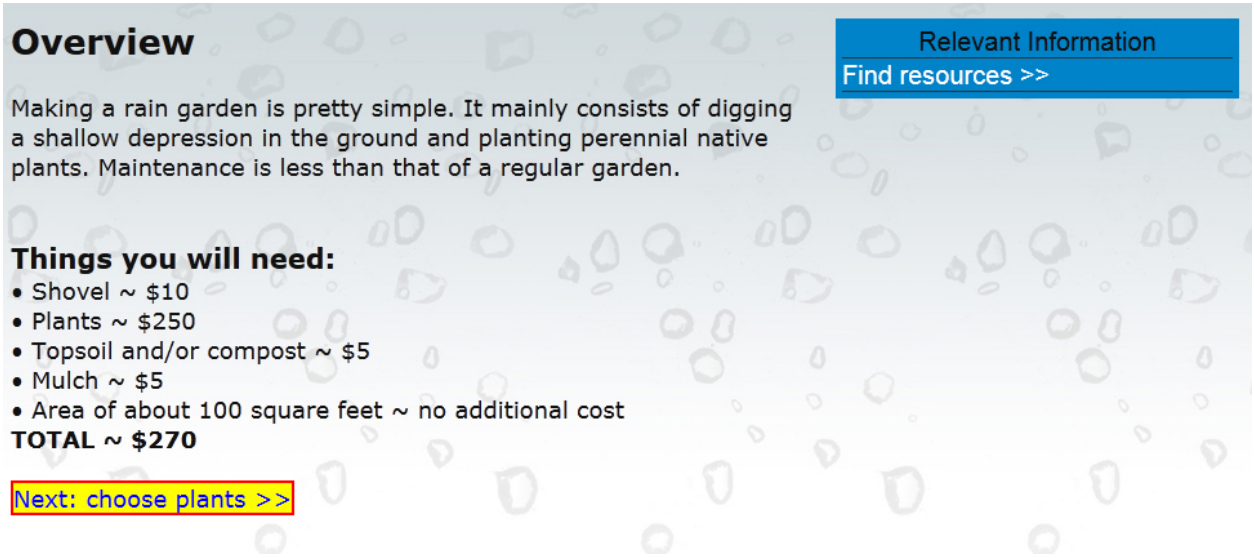


Figure 47: Website overview

At the bottom of the page there is a link to the next step in the process, showing that there is a defined order in which the pages must be viewed. Users are still able to jump into any of the pages in the procedure, but if they are not taken in the right order they only serve an informational purpose.

The link at the bottom of each of the instructional pages is differentiated from the rest of the content so that it might not go unnoticed by the user. Robin Williams argues that if two elements are meant to be different they should be distinctively different. Since no other sections contain links that enforce a structured sequence among its pages, this hyperlink had to be brought

to the user's attention. The colors red and yellow are not found anywhere else on the website, so they were used to create this contrast.

6.3 Conclusion

The usability of our website depends on the site's navigation, layout, content and aesthetics. The website is constructed upon tasks that take advantage of the medium's strengths. By using the navigation to structure the information, the layout to accommodate users' intuition, content to clearly convey the information and aesthetics to supplement and reinforce the main message, we have created a website that aids the users in accomplishing the given tasks. Making it easy for visitors to use the website allows them to better understand the message of our promotional materials and, in conjunction with the brochure and the video, helps them realize that by building a rain garden in their homes they can contribute to overcoming the seemingly insurmountable problems of water pollution and flooding present in the city of Worcester.

Chapter Seven: Conclusion

In this project we created promotional materials for rain gardens in the city of Worcester. These materials include a brochure, a video and a website. In their creation we took into consideration established design principles, common practices and direct input from our target audience. The purpose for having created these materials is to show homeowners in Worcester that by building rain gardens in their houses they can help reduce the flooding and water pollution problems in their homes and in the city of Worcester as a whole.

We chose to create a brochure, a video and a website because each of these different media has its own strengths and weaknesses. By combining these materials we take advantages of the strength of each medium. The brochure is a more easily accessible medium than can be spread to a wider audience because it does not rely on technology, and this way we can distribute it throughout Worcester. The video creates more cognitive engagement and allows us to provoke an emotional response from the viewers and encourage them to learn more about rain gardens. The website can contain more detailed information, so we can use it to elaborate on the benefits and relevance of rain gardens in the city of Worcester and central Massachusetts and to provide visitors with instructions and resources for building their own rain garden.

By combining the strengths of a brochure, a video and a website, we created a powerful library of promotional materials. Now that these materials are available, we hope that they can be used to spread awareness throughout the city of Worcester of the flooding and water pollution issues and we also hope that they can help people realize that by making an individual effort they can contribute to overcoming a seemingly insurmountable problem. This could be achieved by distributing these materials to businesses and organizations such as local nurseries, landscapers, realtors and Community Development Corporations. Creating a community online,

ideally through the website, would give people in Worcester to share their experiences, encourage one another and help in the promotion of rain gardens in the city. Allowing people to register their rain gardens in one particular place and allowing them to use our logo would also helps unify all efforts of making rain gardens in Worcester. Improving the materials we have created and making a greater effort to create a sense of community around them would also help in setting Worcester as an example to its neighbors for addressing flooding and water pollution issues in an economic, environmentally friendly and beautiful way.

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Appendix A: How to Make a Rain Garden

How to Make a Rain Garden

1. The first step in making your own rain garden is to find the right location.
    - ❖ It should be near locations of downspouts and other drainage.
    - ❖ The lowest point in the garden must be at least 10 feet away from your home or building to protect foundation.
    - ❖ It should have areas with sunlight.
    - ❖ You should avoid placing it in areas that tend to have poor drainage to avoid prolonged pooling.
2. You must then test the soil.
    - ❖ Using a percolation test, dig a small hole about 6 inches deep and fill it with water. If there is still water in the hole after 24 hours this area is not good for your rain garden.
3. The next step is choosing the size.
    - ❖ To accurately choose the size you must first measure your homes footprint. This can be done by finding the area your house takes up.
    - ❖ Then, estimate how much of that area will drain into the garden by looking at the downspouts from your gutters.
    - ❖ The rain garden should be approximately 1/3rd of the size of your homes footprint
    - ❖ From here you can make the garden any shape according to the size.
4. Next, you must dig your rain garden.
    - ❖ Most at home rain gardens can be dug with just a shovel. Before digging, make sure that there are no underground utilities that could potentially be damaged.
    - ❖ For a flat area, you can dig about a depression about 12 to 24 inches deep.
    - ❖ If the area is sloped, you will still dig the same size depression but you may need to construct a small barrier at the low end of the garden called a berm to ensure that none of the pooled water leaves the garden.
5. Lastly you must choose your plants.
    - ❖ Once the rain garden has been dug, topsoil, compost, sand, or a combination needs to be added to the soil to aid in draining the water.
    - ❖ The best plants for a rain garden are plants that can tolerate wet conditions and dry periods.
    - ❖ Perennials, shrubs, grasses, and small trees are the most commonly used plants but these plants vary depending on your location.
    - ❖ Finally a layer of shredded hardwood mulch should be put to help prevent the growth of weeds and to conserve moisture. This must be hardwood otherwise the mulch will float when the water begins pooling.
6. Afterwards, you must maintain.
    - ❖ Maintaining a rain garden is very much like maintaining any normal form of landscaping.
    - ❖ Until the plants are established in their environment, they will need to be watered during dry periods.
    - ❖ Weeding should be performed as needed or to your own preference.

Appendix B: Worcester Rain Garden Native Plants Collection

This is a collection of native plants that can be used for Worcester local rain gardens. They are in form of dry, moist and wet tolerance groups. Dry tolerance species are grown in the edge of rain gardens because they can resist dry condition. Then, moist species are added in the slope of rain garden because this area is moist most of the time. Last, wet tolerance species are grown in the center or base of rain gardens because this area needs to collect a large amount of water. So, native plants that stay in this area are needed to be tolerant to wet conditions. All three groups of Worcester rain garden native plants are provided here with common and scientific names, kinds, and bloom or cluster time.

Tolerance condition	Plants name		Kinds of plant	Bloom/Cluster time
	Common name	Scientific name		
Dry (For edge)	American Holly	*Ilex opaca*	Trees/ Shrubs	Spring-Summer
	Arrowwood Viburnum	*Viburnum dentatum*	Trees/ Shrubs	Spring-Summer
	Bayberry	*Myrica pensylvanica*	Trees/ Shrubs	Late spring
	Bearberry	*Arctostaphylos uva-ursi*	Grasses/Groundcovers	Summer-Fall
	Black-eyed Susan	*Rudbeckia laciniate*	Wildflowers/Ferns	Summer-Fall
	Broomsedge	*Andropogan spp.*	Grasses/Groundcovers	Fall
	Deer Tongue	*Dichanthelium clandestinum*	Grasses/Groundcovers	Fall
	Hackberry	*Celtis occidentails*	Trees/ Shrubs	Spring-Summer
	Indiangrass	*Sorghastrum nutans*	Grasses/Groundcovers	Fall
	Little bluestem	*Schizachyium scoparium*	Grasses/Groundcovers	Summer-early winter
	Lowbush Blueberry	*Vaccinium angustofolium*	Trees/ Shrubs	Summer
	Milkweed	*Asclepais tuberose*	Wildflowers/Ferns	Summer
	Purple Coneflower	*Echinacea purpurea*	Wildflowers/Ferns	Spring - Summer
	Red Bud	*Cercis canadensis*	Trees/ Shrubs	Spring
	Red Oak	*Quercus falcata*	Trees/ Shrubs	Spring

	Switchgrass	*Panicum virgatum*	Grasses/Groundcovers	Summer- Fall
	White Oak	*Quercus alba*	Trees/ Shrubs	Spring
	Wild Bergamont	*Monarda didyma*	Wildflowers/Ferns	
	Wild Indigo	*Baptista tinctoria*	Wildflowers/Ferns	
	Witchhazel	*Hamamelis virginiana*	Trees/ Shrubs	
Wet (For center /base)	Bluejoint Grass	*Calamagrostis canadensis*	Grass/Groundcovers	Fall-Winter
	Blue Lobelia	*Lobelia siphilitica*	Wildflowers/Ferns	Fall-Winter
	Bluefrag Iris	*Iris virginica shrevei*	Wildflowers/Ferns	Spring- Summer
	Boneset	*Eupatorium maculatum*	Wildflowers/Ferns	Fall
	Buttonbush	*Cephalanthus occidentnalis*	Trees/Shrubs	Fall
	Cardinal Flower	*Lobelia cardinalis*	Wildflowers/Ferns	Summer-Fall
	Cranberrybush Viburnum trilobum	*Viburnum trilobum*	Trees/Shrubs	Spring
	Fowl Mannagrass	*Glyceria striata*	Grass/Groundcovers	Summer
	Green Ash	*Fraxinus pennsylvanica*	Trees/Shrubs	n/a
	Marsh Marigold	*Calthus palustris*	Wildflowers/Ferns	Summer
	River Birch	*Betula nigra*	Trees/Shrubs	Spring
	Rose-mallow	*Hibiscus moscheutos*	Wildflowers/Ferns	Summer-Fall
	Royal Fern	*Osmunda regalis*	Wildflowers/Ferns	n/a
	Sedges	*Carex spp.*	Grass/Groundcovers	Summer-Fall
	Silky Dogwood	*Cornus amomum*	Trees/Shrubs	June
	Soft Rush	*Juncus effuses*	Grass/Groundcovers	Late summer
	Swamp White Oak	*Quercus bicolor*	Trees/Shrubs	n/a
	Turtlehead	*Chelone glabra*	Wildflowers/Ferns	Summer-Fall
Moist (For slope)	Big Bluestem	*Andropogon gerardii*	Grasses/Groundcovers	Fall-Winter
	Blazing Star	*Liatris spicata*	Wildflowers/Ferns	Summer-Fall

	Cinnamon Fern	*Osmunda cinnammea*	Wildflowers/Ferns	n/a
	Columbine	*Aquilegia spp.*	Wildflowers/Ferns	n/a
	Coreopsis	*Coreopsis*	Wildflowers/Ferns	Spring
	Green Ash	*Fraxinus pennsylvanoca*	Trees/Shrubs	Summer-Fall
	Ironweed	*Vernoia noveboracensis*	Wildflowers/Ferns	n/a
	Joe-pye Weed	*Eupatoriun spp.*	Wildflowers/Ferns	Summer
	New England Aster	*Aster novae-angliae*	Wildflowers/Ferns	Spring-Fall
	New York Aster	*Aster novi-belgii*	Wildflowers/Ferns	Spring-Fall
	Red Maple	*Acer rubrum*	Trees/Shrubs	Early summer
	Red-twig Dogwood	*Cornus sericea*	Trees/Shrubs	Late spring
	River Birch	*Betula nigra*	Trees/Shrubs	Late winter
	Sensitive Fern	*Onoclea Sensibilis*	Wildflowers/Ferns	n/a
	Serviceberry	*Amelanchier canadensis*	Trees/Shrubs	Spring
	Sweet pepperbush	*Clethera alnifolia*	Trees/Shrubs	Summer-Fall
	Sweet bay Magnolia	*Magnolia virginiana*	Trees/Shrubs	Spring
	Virginia Wild-rye	*Elymus virginocus*	Grasses/Groundcovers	Summer
	Winterberry Holly	*Ilex verticillata*	Trees/Shrubs	Fall-Winter
	Wood Grass	*Sorghastrum nutans*	Grasses/Groundcovers	n/a

Appendix C: Phone Call Interview Questions

1. Did you know that during that heavy rainfall excessive amount of rainwater runoff enters into the combined sewer system, did you know that during period of heavy rainfall there is flooding here in Worcester, personally on a scale of one to five, how often does this problem affect you?

2. Did you know that when the combined sewer systems reach their max capacity, the city is forced to dump raw sewage into the Blackstone River? Did you know that the City of Worcester is fined for this dumping of raw sewage? How knowledgeable are you about this problem on a scale of 1 to 5, one being not at all and 5 being very knowledgeable?

3. Are you familiar with Rain Gardens? If you are what can you tell me about them

4. Do you know the benefits of having a rain garden? Rain gardens can positively affect you in many ways,

5. How interested are you in the Financial benefits in a rain garden, how a scale of 1 to 5?

6. How interested are you in the Environmental benefits of a rain garden, on a scale of 1 to 5?

7. How interested are you in the Social/Visual appeal of having a rain garden, on a scale of 1 to 5?

8. How interested are you in building a rain garden? On a scale of 1 to 5

Appendix D: In Person Interview Question and Documentation Sheet

Hello Mr./Ms. _____ thank you for participating in our design review of our outreach materials for our rain gardens project. We will do our best to ensure that this process goes as quickly as possible and that you learn something from our outreach.

The Process

1. Rate the brochures on a scale (1 being your favorite, and 3 being your least favorite)
    a. Also ask what they liked about the first one, and what they liked the least about their last choice
2. Rate the web pages on a scale (1 being your favorite, and 4 being your least favorite)
    a. Ask about what they like about their favorite one, and what they like least about their last choice

Usability Testing

We will be able to do this starting Friday, (make sure to reserve a room for Monday and Tuesday)

Have them navigate through the website, talk about what they are doing, about what aspects/information about or on the website they are trying to find. Also this will help because we will be able to document what issues are troubling them when it comes to just moving around in our website.

At the end of the navigation process we have them answer a small quiz (multiple choice quiz) to see how much information they were able to pick up on just by navigating through.

We thank them for their time and how they agreed to participating in the project.

Appendix E: Worcester Rain Gardens Logo Development

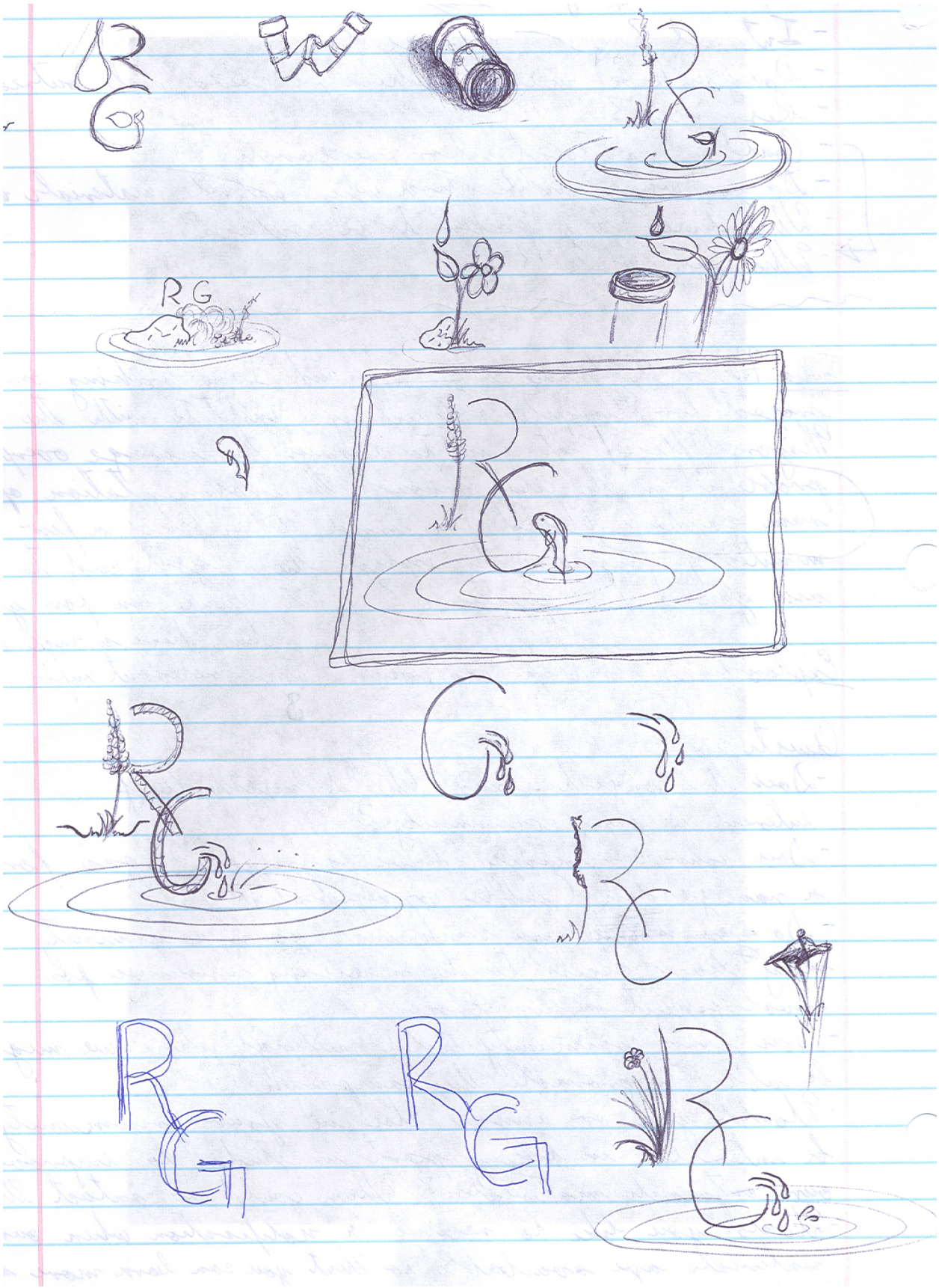
December 15th, 2011
WPI Rain Gardens Team

Rationale Behind the Logo

We wanted to create an image that would unify all of our promotional materials and the campaign for rain gardens in Worcester. We were aiming for an image that would illustrate what rain gardens are and that would reflect its simplicity. Our final product displays a simple flower with a large drop of polluted water coming in and small drops of clean water coming out. This is meant to show how a simple rain garden can help with controlling the flow of rain water and to also improve the quality of the water that goes back into the environment. The colors in the logo are taken from the Worcester logo.

Other Final Versions

Note: The following pages are pictures that show the progress in the development of the logo.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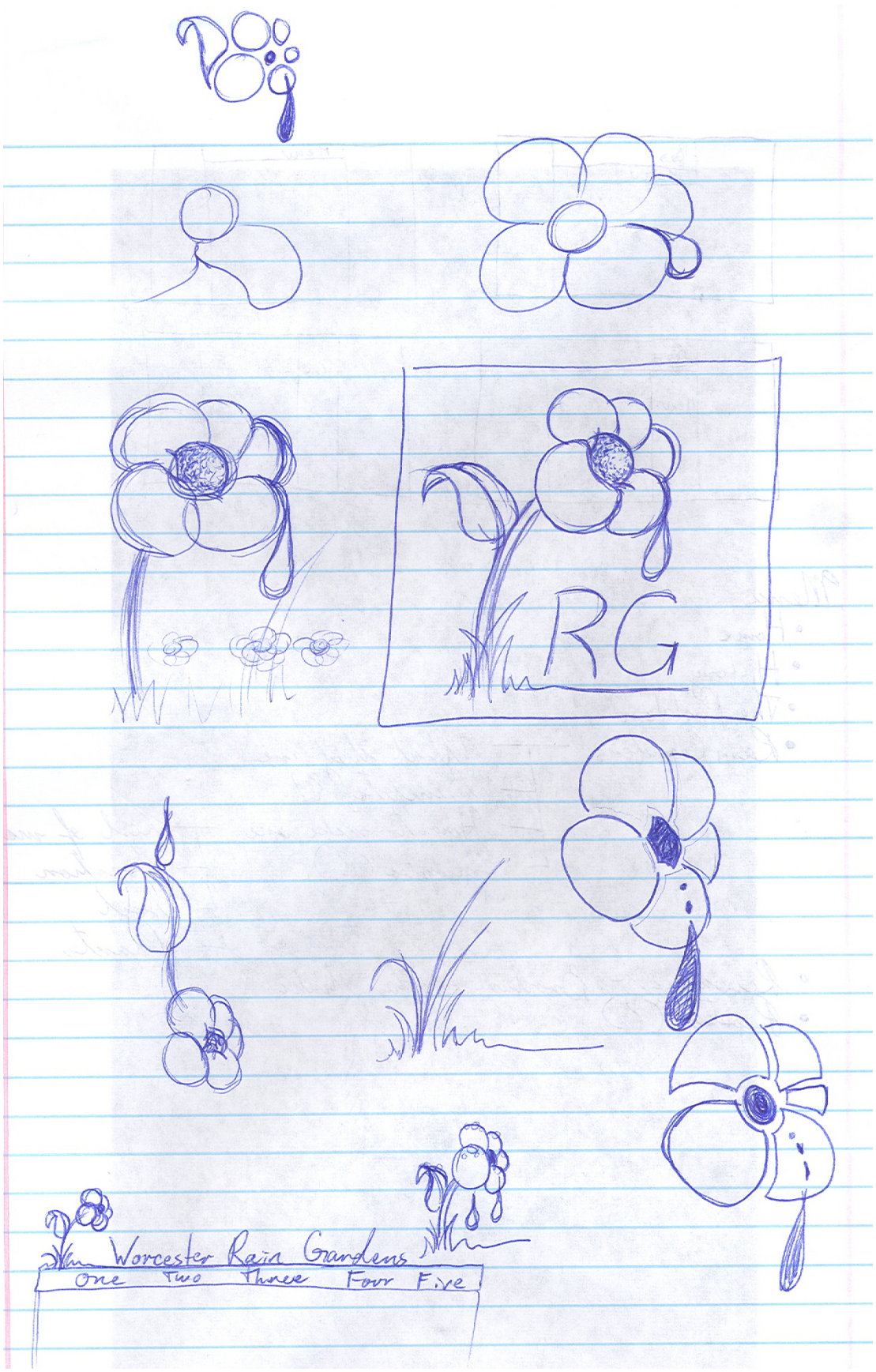
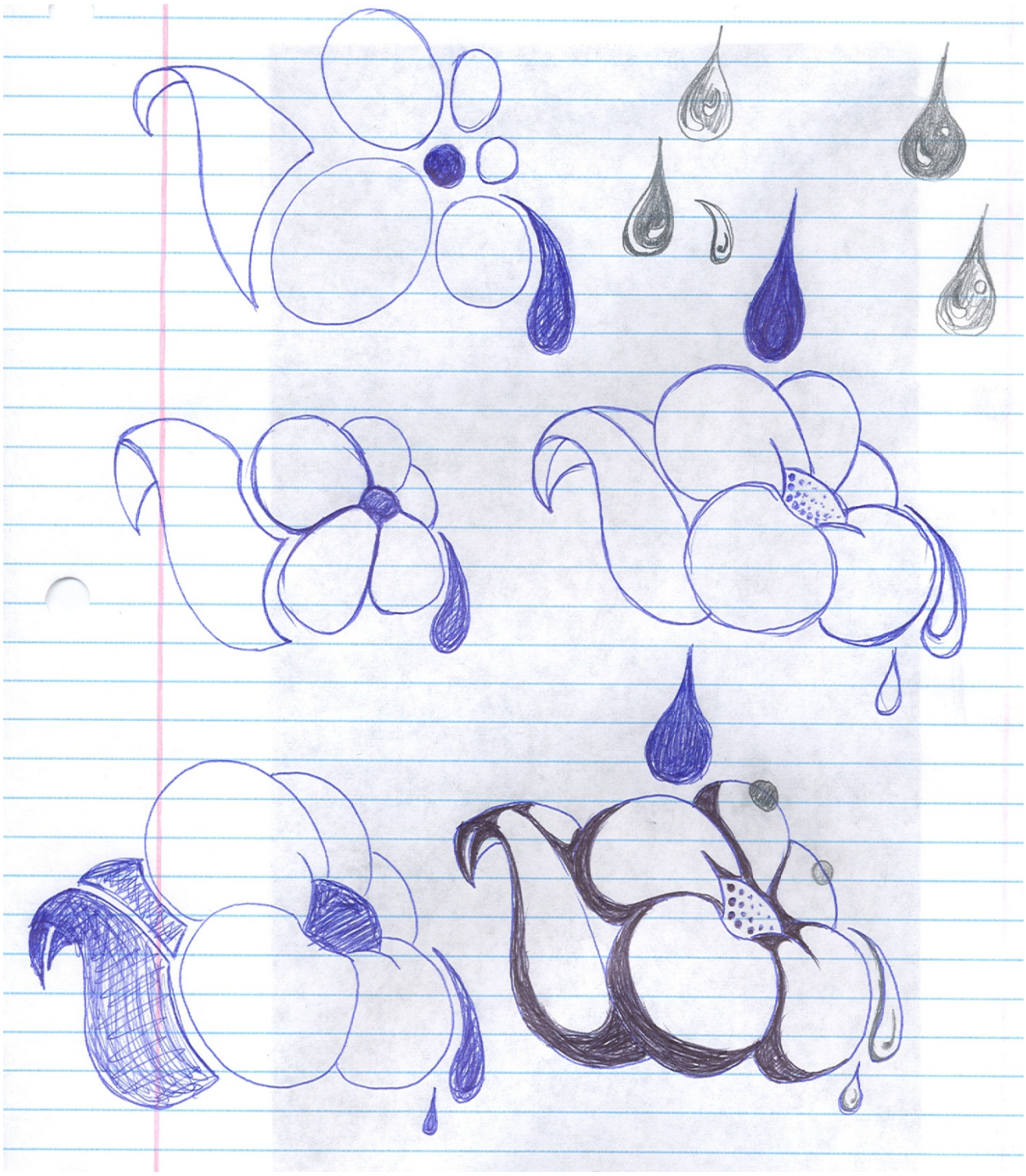
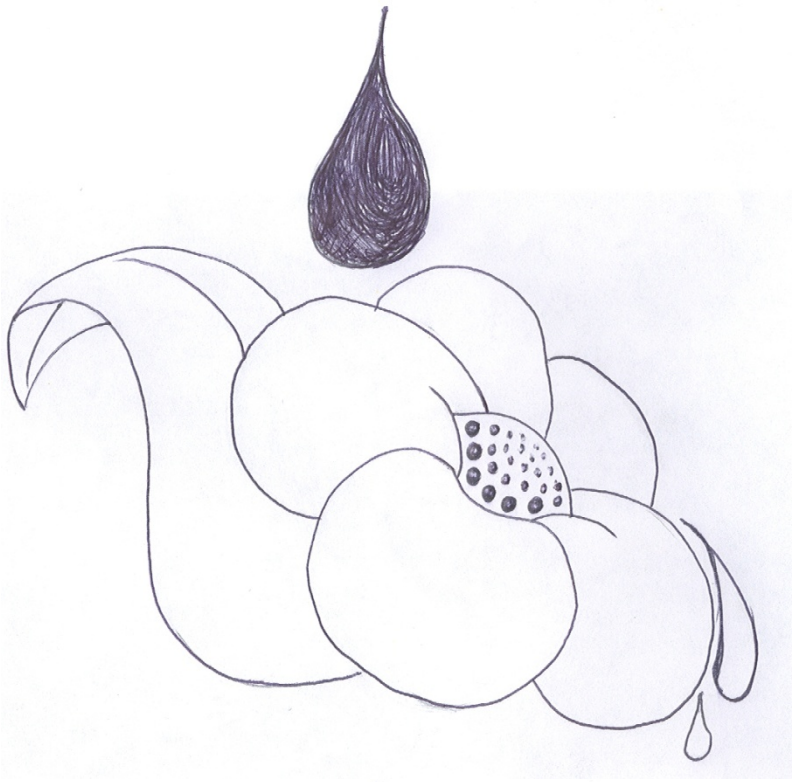
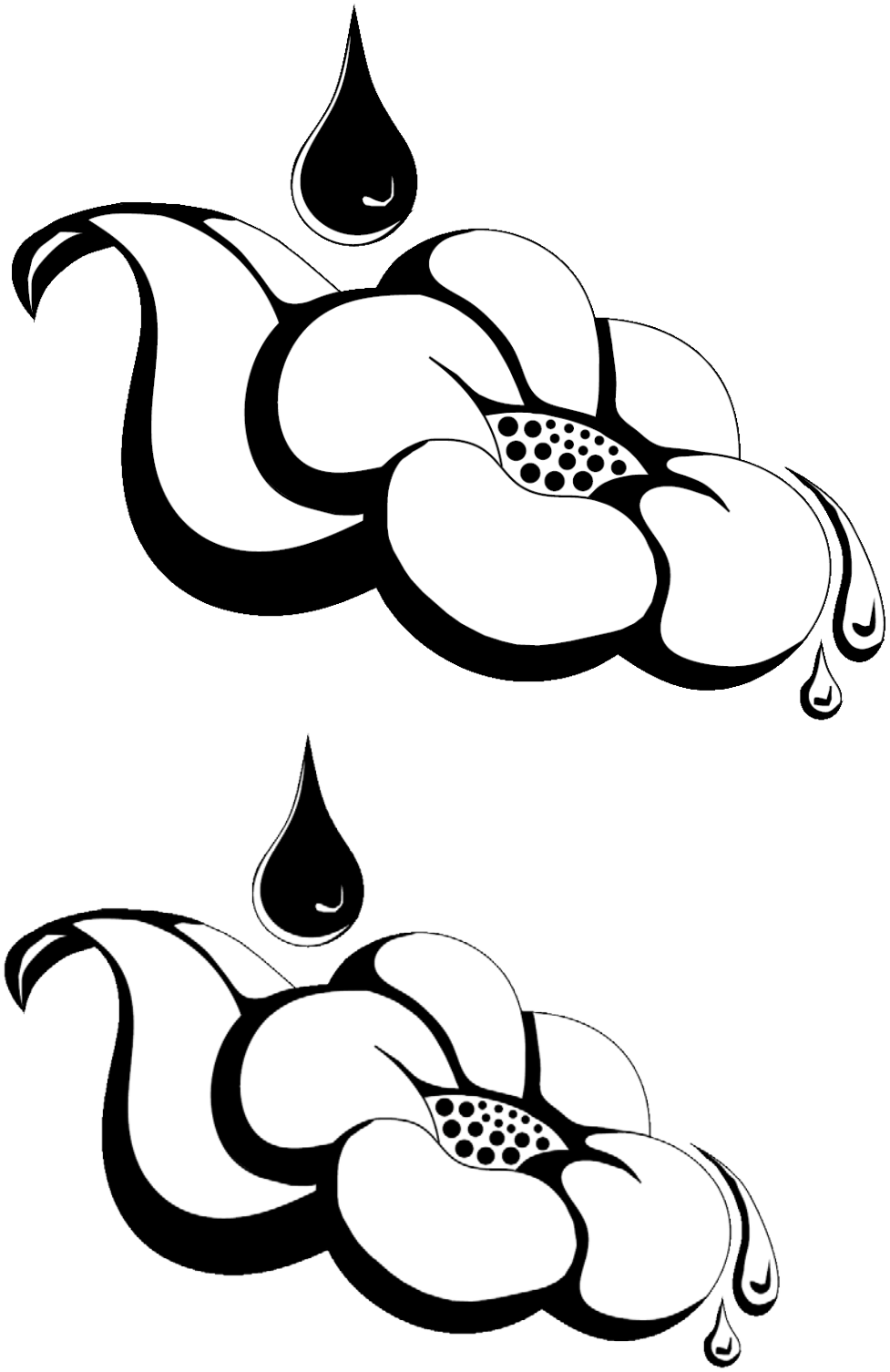
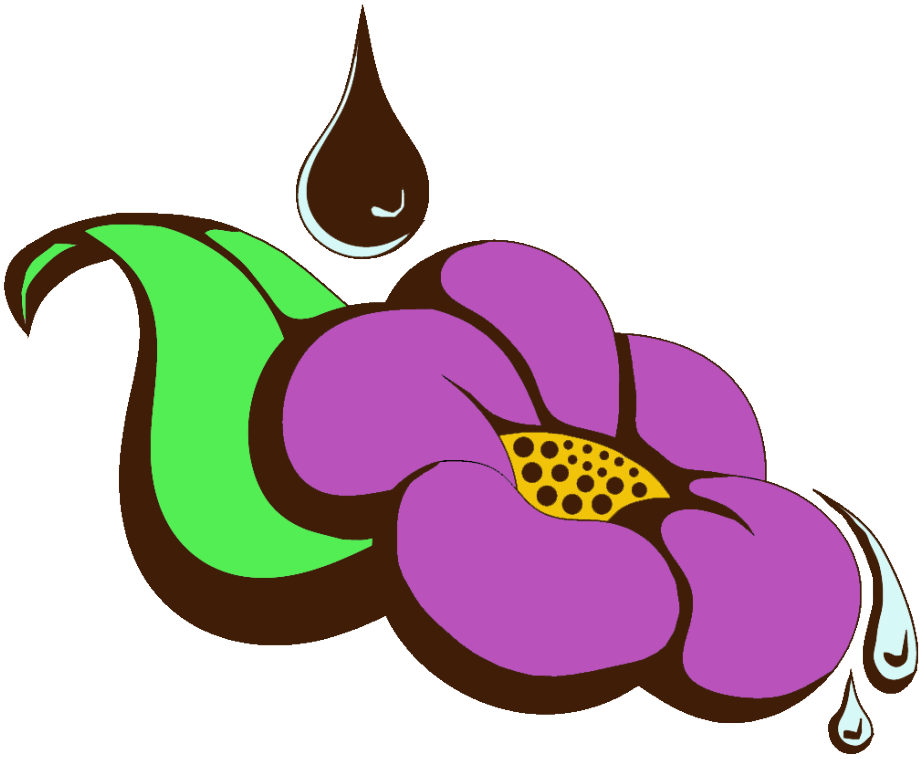

RG
Worcester Rain Gardens
One Two Three Four Five

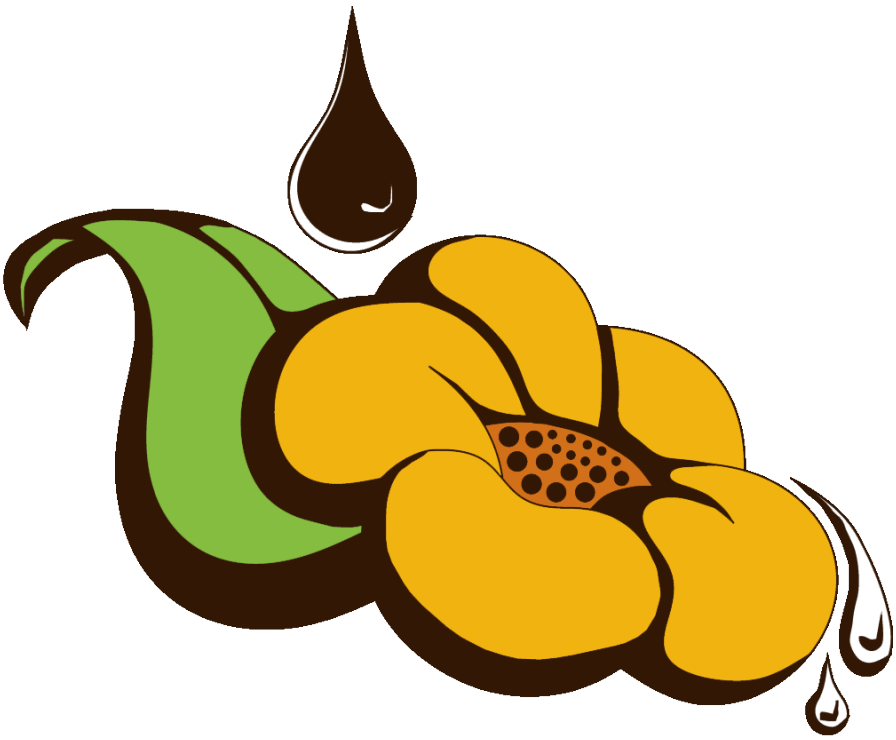

Rain Gardens

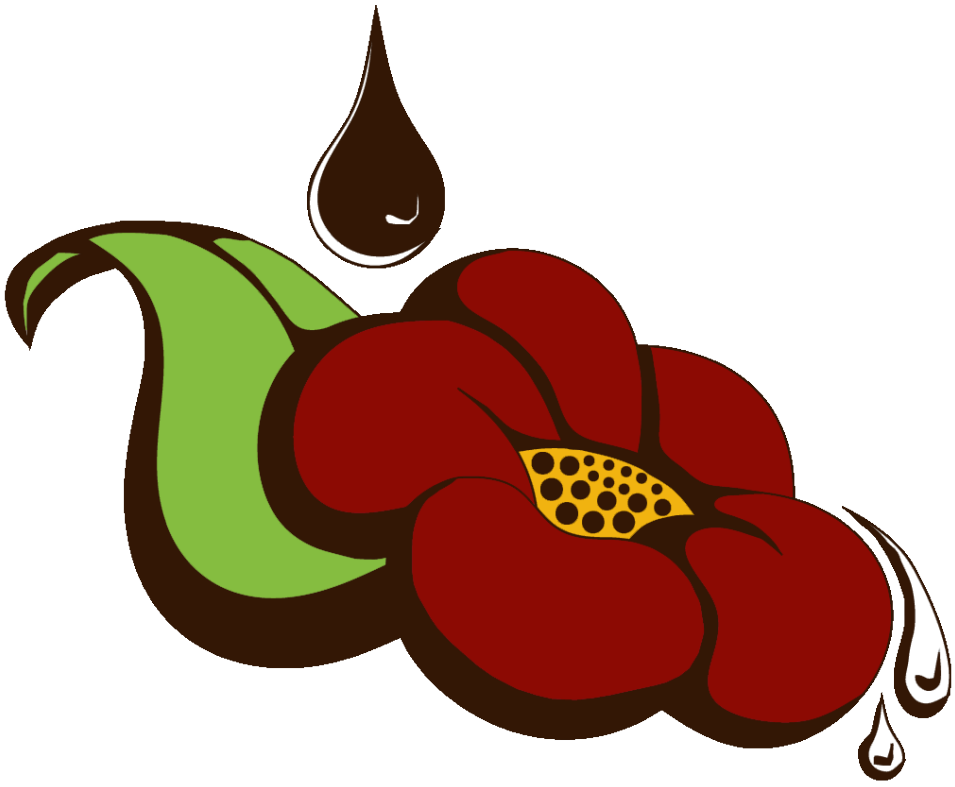


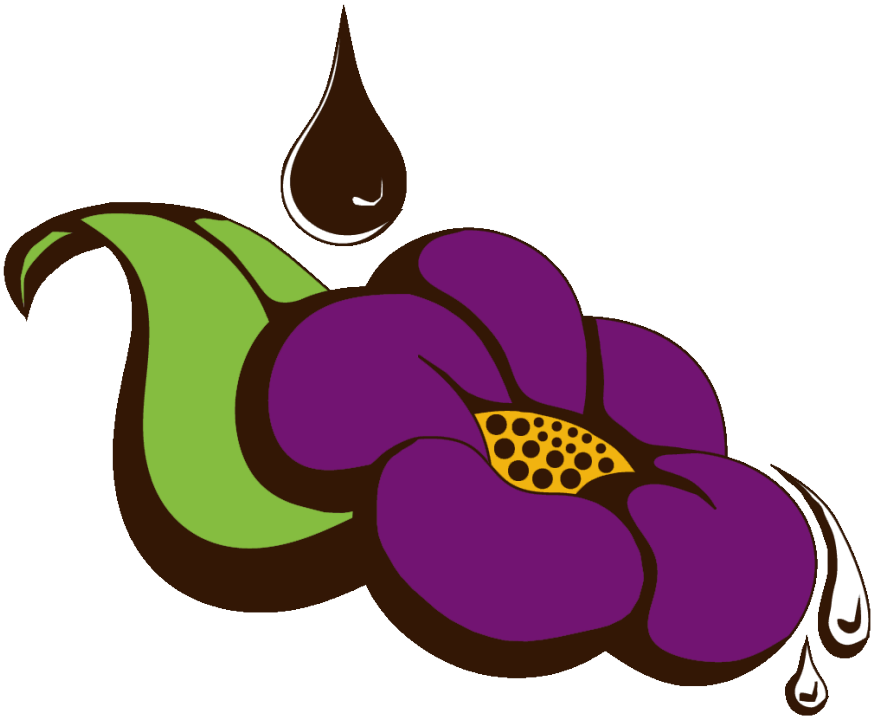


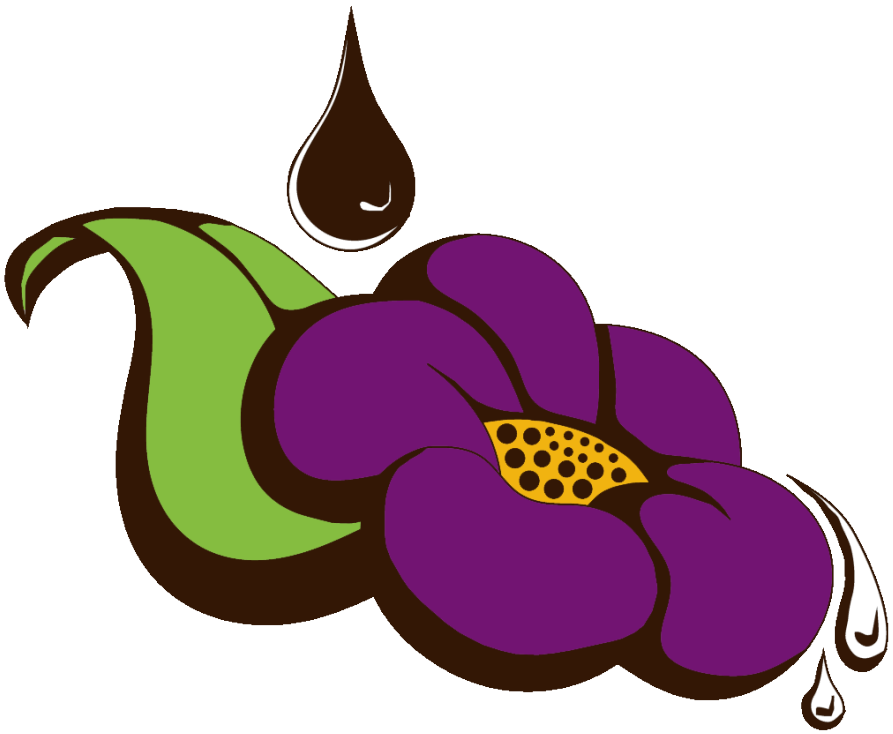

WORCESTER
RAIN GARDENS











WORCESTER
RAIN GARDENS

Appendix F: Brochure Feedback Collection and Relevancies

This is a collection of feedbacks that we received from target audiences. We asked the for the brochure's contents and designs. This helped us to figure out if the brochure's contents follow the purposes and the target audiences' design's preference. if the designs including contents are preferred to take a look and read by Worcester communities can be found out by this interview sheet. The table below demonstrates the feedbacks and relevancies

#	Feedbacks	Relevancies
1	Introduction on rain garden is confusing.	Introduction is needed to be understandable of complete description of rain garden.
2	Introduction part should be in form of complete text that is not too long, but able to cover complete and understandable of rain garden's description.	
3	In the part of water pollution, too scientific or technical words cannot make understand in some groups of target audiences.	Reduce using of too scientific words and explain in simple way.
4	The contents were not connected well, easy to get lost.	Check through and move elements to be well connected.
5	The contents' theme that was changed during the brochure can confuse reader's feeling.	Make sentences to follow the same concept. Because the project team was created contents to express feeling of friends' conversation to the target audience, vocabularies and sentences are needed to follow the same expression theme.
6	They wanted to know more on impervious surface, and why it cause pollutants.	The brochure is needed to have a simple explanation of the topic of impervious surface and pollutants that is causing by runoff from impervious surface.

According to table 10, we are going to discuss in more detail on each feedback:

Contents connection and writing style were needed to improve. Introduction of rain garden that was not clear enough can bring reader to be confused. One of target audience interviewee suggested us to restate introduction part of rain garden. Most feedbacks preferred the introduction part to be informed of complete text that is not too long, but able to cover complete and understandable of rain garden's description. Other suggestions were dealing with vocabularies that were used. In the part of water pollution, too scientific words cannot make understand in some groups of target audiences. Also, some part can be improved to be more understandable. The project team realized that we needed to simplified words. A couple of target audience also explained that they feel that the contents were not connected well. They got lost when the contents in brochure was jumped to native plants without guiding idea of plants for rain gardens before. Also, contents' theme that was changed during the brochure can confused reader's feeling. Because the project team was created contents to express feeling of friends' conversation to the target audience, vocabularies and sentences are needed to follow the same expression theme. Table 5 shows the feedback on contents from the target audiences.

More and large pictures were preferred. According to the feedback, large picture on the cover can grab the target audiences' attentions more. Most target audiences like to see the beautiful of rain garden design on the cover. Large and great quality of picture made them want to grab the brochures. The inside of the brochure should have more pictures that are related to the context too. This made them want to read the brochure. They can also feel that the brochure provides movement of product to them not just plain of a paper. So, the project team had some idea of providing more picture of rain garden and beautiful native plants might be a great choice for this preference.

Graphic and colors helped reader to pay attention more on the brochure. The title on the cover could be provided with better movement of graphic font. This can help more on advertisement because reader tent to pick brochures with more movement of graphic design in the cover. Thus, highlight with a larger font size and strong colors design can enhance the brochure's advertisement ability. In addition, the cover should have a Worcester logo because it helps the brochure to look reliable and professional. For colors, most target audiences liked the how to make a rain garden with colorful colors design that is guided by Worcester logo's idea. They explained that it was really show up when they open the brochure. With reading this table, they could understand how to a rain garden in simple way. In addition, they preferred green and

blue because it expressed a feeling of green communities to them. The project team wanted to use water lines of logo for the background, but the target audiences did not understand that it works. This was because it did not show up enough to explain the brochure. Movement of graphic and colors design could be improved to enhance an ability to grab the target audiences' attention of the brochure.

Appendix G: Brochure Revision

This appendix is going to cover how we make a revision for the brochure. Revision and finalization of the brochure were according to the target audiences' feedbacks. According to Media analyst Bear's statement (1997), he point out that media prototypes should be revised based on the information collected feedbacks. Therefore, assess phase was used to conduct interviews to collect the target audiences' opinions. The project team analyzed the results of assessments and identified tasks that are needed to improve in the final version of brochure. By having analyzing of collect feedbacks, these were applied to finalize the brochure. We simplified how we revised for the brochure in table A below.

Table A: Task and Revision of the Final Brochure Version

# Panel	Tasks Revision
1st /cover	A larger and great quality of a beautiful rain garden with a house picture to persuade the target audience to look at the brochure at the first place.
	More movement of graphic font was applied to the title of "let's make a rain garden" in order to support it to pop up more in the target audiences' eyes. This also added to brochure to looks fresh with dynamic movement of graphic font.
	Strong colors to highlight words of are cool facts and benefits of rain garden to enhance persuade ability to bring the target audiences to open and read through the brochure
2nd	Make it like a story telling style.
	Rain garden's description was checked to cover enough detail on rain garden with using simple and concise words and sentences.
	A complete and short reason why runoff needs to be filtered by rain gardens was improved in sentence and words to be more understandable.
	Reduce using of too scientific and technical terms were not preferred
3rd and 4th	Moved how to make a rain garden to be on top of the 3rd and 4th panels.

	Added native plants examples on the below space with their pictures.
	Cost was added on the top of how to maintain rain garden.
	Great quality of rain garden provided between how to make and maintain a rain garden.
	The overall sentences and writing styles were followed the same concept and expression theme.
5th and 6th	Improved clear explained answers for concerns questions that the target audiences might have. Connect a question by answer from previous question to help reader to read through the brochure easily
Overall panels	Improved in grammar and writing style.
	Too technical terms were deleted.
	The sentences are needed to follow the same expression theme.
	Applied more on alignment for content, picture, table, and space.
	More suggestions from stakeholder and the project team's prove read were applied.

According to table A, we will discuss in more detail on how we revised from each task:

The cover of the brochure that is needed to grab the target audiences' attention was revised to accomplish its job and be ready to be picked up by Worcester community. One of the tasks that was revised for the cover was a larger and great quality picture. It is needed to have in the cover in order to grab reader's attention. The project added a large and great quality of a beautiful rain garden with a house picture to persuade the target audience to look at the brochure at the first place. This picture also helps to educate reader who has never seen rain gardens before to have a sense of how they look like. Then, more movement of graphic font was applied to the title of "let's make a rain garden." This sentence was strongly expressed the brochure goal, so it was needed to enhance graphic design in order to support it to pop up more in the target audiences' eyes. This also added to brochure to looks fresh with dynamic movement of graphic font. Last task was an applying of strong colors to highlight words that are needed to show up. These words are needed to be emphasized because they are cool facts and benefits of rain garden

that can help to persuade the target audiences to open and read through the brochure. Revision of the brochure were mainly to enhance it to the target audiences' attentions with large and great quality of rain garden picture, graphic font of title, and strong highlighting cool fact and benefit of rain garden.

The project team revised introduction part in the 2nd panel that is needed to ensure that reader can completely understand rain garden with reading this part. This was created to like a story telling style. The project introduced rain garden with what it is and connected with why it is needed. These two were linked and followed alignment principle of well-designed works. The beginning that explains rain garden's description was checked to cover enough detail on rain garden. It is also easily to understand with using simple and concise words and sentences. Next, the reason why runoff needs to be filtered by rain gardens was improved in sentence and words to be more understandable. These parts are not only needed to be complete, but they also should be short. This is because readers do not prefer too much text. In addition, brief paragraph of sewage overflow in Worcester and water pollution in the Blackstone Rive were rewritten here. These sentences were expressed with simple vocabularies because too scientific and technical terms were not preferred by the target audiences according to the feedbacks. These parts are needed to be clearly present and draw target audiences to want to know more on sewage overflow in Worcester and water pollution in the Blackstone River. The 2nd panel was revised mainly on writing style to be like a story of solution and problem in order to introduce the target audiences to rain garden and problems that can be solved by making rain gardens.

The contents in the 3rd and 4th panels were moved and rewritten to follow alignment of design along with adding more related pictures. The project team moved how to make a rain garden to be on top of the 3rd and 4th panels. Then, the space below was used to show native plants examples with their pictures. This related to the process of making rain gardens information. In addition, cost was selected to be on top of how to maintain rain garden. This is because the project realized that reader wanted to know cost of making a rain garden after they had known how to make a rain garden. Great quality of rain garden provided between how to make and maintain a rain garden. This supports alignment principle of visuals and elements of the brochure that was mentioned in a Non-Designer Designed book by Robin Williams (2003). The overall sentences and writing styles were followed the same concept. Because the project

team was created contents to express feeling of friends' conversation to the target audience, vocabularies and sentences are needed to follow the same expression theme

The 5th panel was revised to improve a writing style and sentence connection. This panel was provided clear explained answers for concerns questions that the target audiences might have. Therefore, the project tried to connect a question by answer from previous question. This helps reader to read through the brochure easily. In the other words, they can look for more information simply. Also, this makes reader feel that the brochure is organized and professional. Theme of the sentences style here was also followed the expression of friends' conversation style. The project team rewrote 5th panel mainly to look organized and maintain the same writing style and expression theme.

Overall of the brochure was improved in grammar and writing style along with carefully applying of alignment for content, picture, table, and space in order to be suitable to target audiences' preference. Too technical terms were deleted. The sentences are needed to follow the same expression theme. Because the project team was created contents to express feeling of friends' conversation to the target audience, vocabularies and sentences are needed to follow the same theme. In addition, More suggestions from stakeholder and the project team's prove read were applied. Overall of the brochure was improved in professional grammar and writing style to make it fit to the target audiences' preference from analyzed collected data previously.

Appendix H: Analysis of Other Websites

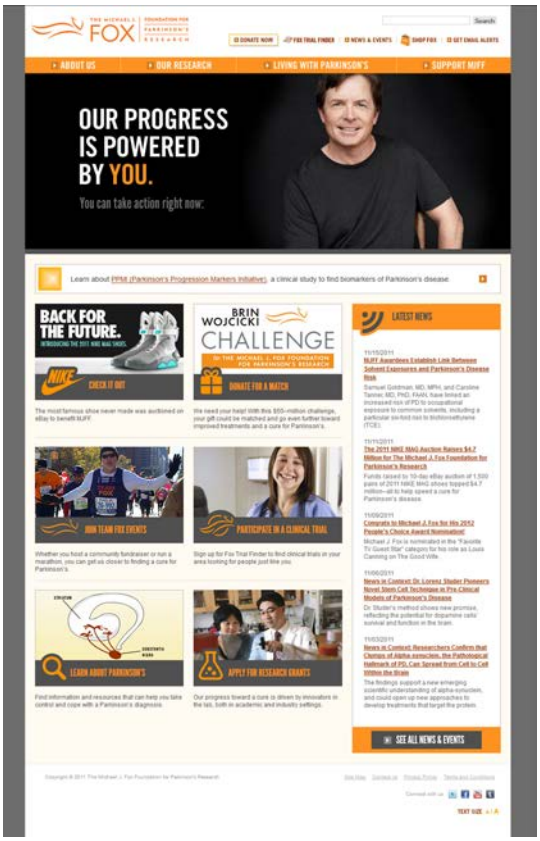
December 15th, 2011
WPI Rain Gardens Team

This document contains the notes of the analyses that were conducted on other websites of non-profit organizations. This was done to find common practices and to determine what would be adequate for imitation in our website.

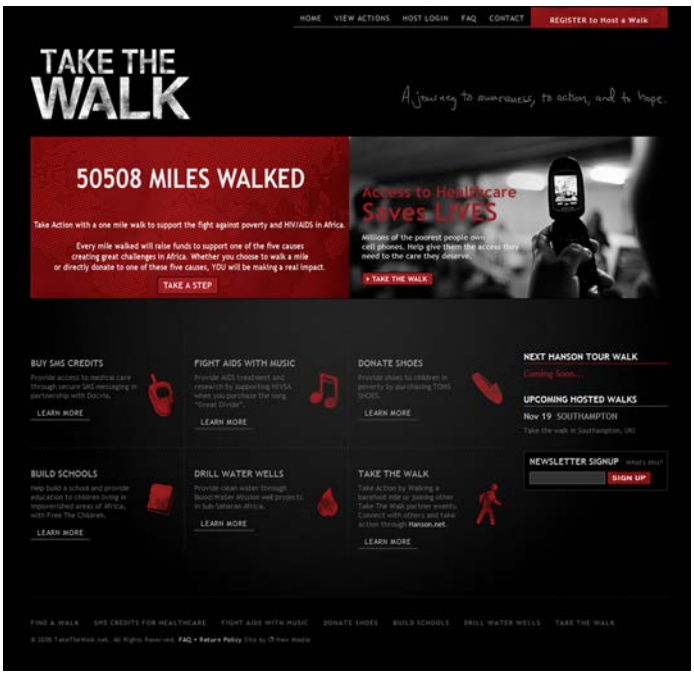
The first four websites that were analyzed were:

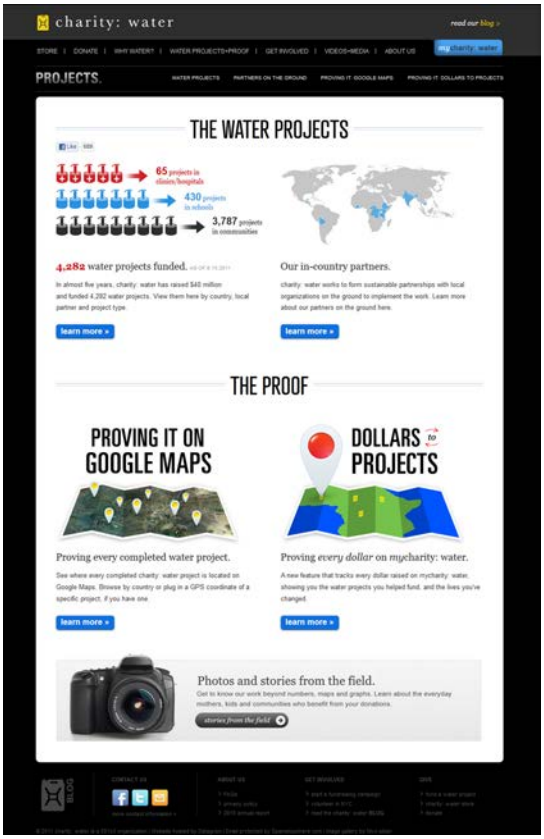
- charitywater.org
- michaeljfox.org
- one.org
- takethewalk.net


charity: water
WATER CHANGES EVERYTHING.
WATCH THE VIDEO.
SPONSOR A WATER PROJECT >
FUNDRAISE FOR CLEAN WATER >
WHAT IS THE WATER CRISIS? >
ABOUT THE WATER CRISIS
1 BILLION.
OUR PROGRESS SO FAR
4,282
2,060,000
19
25
WHY WE'RE DIFFERENT
100%
$20

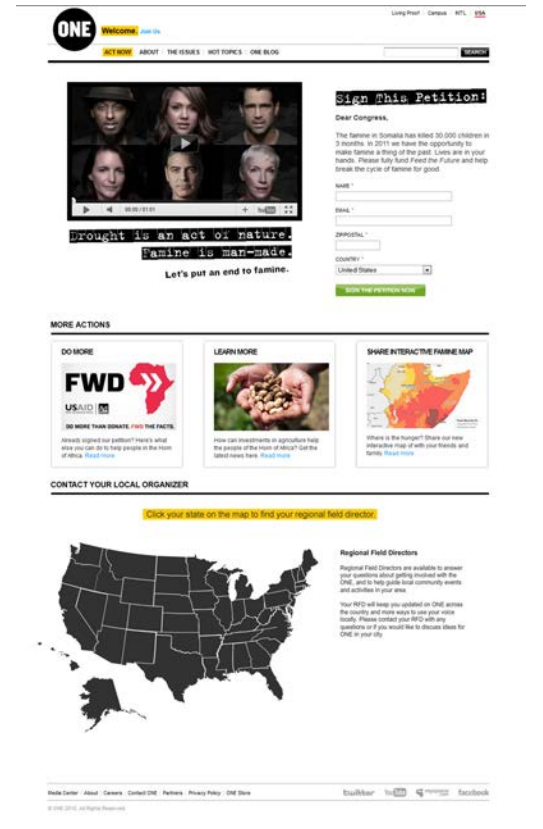

FOX
ABOUT US
OUR RESEARCH
LIVING WITH PARKINSON'S
SUPPORT MJFF
OUR PROGRESS IS POWERED BY YOU.
You can take action right now:
BACK FOR THE FUTURE.
BRIN WOJCICKI CHALLENGE
LATEST NEWS
SEE ALL NEWS & EVENTS

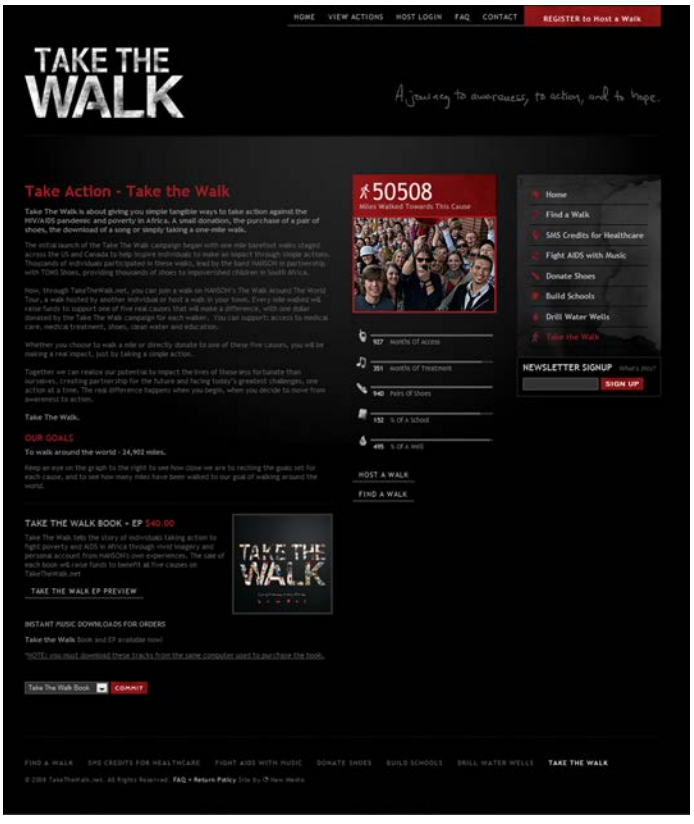

ONE
Welcome.
ACT NOW | ABOUT | THE ISSUES | HOT TOPICS | ONE BLOG
FAMINE
New Video: Imagine a Future Free of Famine
SPOTLIGHT
DO MORE
STORE
BLOG


TAKE THE WALK
A journey to awareness, to action, and to hope.
50508 MILES WALKED
Take Action with a one mile walk to support the fight against poverty and HIV/AIDS in Africa.
TAKE A STEP
Access to Healthcare Saves LIVES
BUY SMS CREDITS
FIGHT AIDS WITH MUSIC
DONATE SHOES
BUILD SCHOOLS
DRILL WATER WELLS
TAKE THE WALK
NEXT HANSON TOUR WALK
UPCOMING HOSTED WALKS
Nov 19 SOUTHAMPTON
NEWSLETTER SIGNUP
SIGN UP


charity: water
PROJECTS.
THE WATER PROJECTS
65 projects in clinics/hospitals
430 projects in schools
3,787 projects in communities
4,282 water projects funded.
Our in-country partners.
learn more »
learn more »
THE PROOF
PROVING IT ON GOOGLE MAPS
DOLLARS to PROJECTS
Proving every completed water project.
Proving every dollar on mycharity: water.
learn more »
learn more »
Photos and stories from the field.
stories from the field


THE MICHAEL J. FOX FOUNDATION FOR PARKINSON'S RESEARCH
DONATE NOW
FOX TRIAL FINDER
NEWS & EVENTS
SHOP FOX
GET EMAIL ALERTS
ABOUT US
OUR RESEARCH
LIVING WITH PARKINSON'S
SUPPORT MJFF
HOW DO WE KNOW THE BEST RESEARCH TO FUND?
WE DO EXTENSIVE RESEARCH OF OUR OWN.
FUNDING OPPORTUNITIES
MJFF RESEARCH TOOLS
CONNECT WITH US
THE MJFF FUNDING PHILOSOPHY
SEARCHABLE DATABASE OF FUNDED GRANTS
FOX TRIAL FINDER IS HERE
MJFF VIEWPOINTS
OPPORTUNITIES FOR INDUSTRY
FOR GRANT AWARDEES
RESEARCHER EMAIL SIGN UP
LEARN ABOUT A STUDY TO FIND PARKINSON'S BIOMARKERS
CONTACT SCIENTIFIC STAFF
REGISTER NOW: ANNUAL PD THERAPEUTICS CONFERENCE


ONE
Welcome.
Sign This Petition:
Drought is an act of nature.
Famine is man-made.
Let's put an end to famine.
MORE ACTIONS
DO MORE
LEARN MORE
SHARE INTERACTIVE FAMINE MAP
CONTACT YOUR LOCAL ORGANIZER
Click your state on the map to find your regional field director.
Regional Field Directors


HOME
VIEW ACTIONS
HOST LOGIN
FAQ
CONTACT
REGISTER to Host a Walk
TAKE THE WALK
A journey to awareness, to action, and to hope.
Take Action - Take the Walk
50508
Miles Walked Towards This Cause
NEWSLETTER SIGNUP
SIGN UP
OUR GOALS
HOST A WALK
FIND A WALK
TAKE THE WALK BOOK + EP $40.00
TAKE THE WALK EP PREVIEW
INSTANT MUSIC DOWNLOADS FOR ORDERS

Layout:
- All 4 websites have a 960 pixel width which centers on the browser's viewport.
- All but one of them (charitywater.org) seems to use a grid for placing their elements on the page.
- The maximum number of imtes they have ona row is 4. This also applies to charitywater.org.
- Even though caritywater.org does not use a grid, it does evenly/proportionally size and space each element within each row.
- On its homepage, michaeljfox.org has three evenly divided columns. This division is common in other non-profit websites. However, on the other pages, michaeljfox.org divides the columns in a 3:3:2 ratio, giving priority to that particular page's content.
- On the act now page, one.org maintains the even three column division. It also takes advantage of the variation where one element in a row will span two columns (generally the leftmost ones).
- The talkethewalk.net website maintains an even fours column division across its pages.
- All websites have their logo and name on the top left corner (the logo on the left of the name).
- Most websites have utilities and/or a search bar on the top right corner of the page. Most have a call to action button near this area.
- Three out of the four websites have a horizontal navigation bar. This is most common on non-profit websites.
- Takethewalk.net 's navigation is the content of the home page. It becomes a right side bar in other pages.
- Under the logo and menu, all sites have a header of varying characteristics. They all feature large graphics. This is in the home page.
- Some sites, like michaeljfox.org, retain a header in the other pages of the website.
- Right under the header is the home page's content. This includes usually: something the visitor can do, something the visitor can learn, news, blogs, a way to keep informed/connect. Some of the sites also include a way to show progress/achievements directly on the home page. In takethewalk.net this progress is shown on the header. In charitywater.org it is shown near the bottom of the page.
- All sites have footer at the bottom of the page. Here they might repeat utilities, navigation links, and social networking options.

Navigation:
- As mentioned in the previous section, almost all sites use a horizontal bar near the top of the page for navigation.
- This menu includes things like: about us, about the issue, what we are doing, what you can do, donate, news, blog.
- Navigation is also supported by search bars, links in the footer, and side bars. This is besides the hyperlinks that are found throughout the content of the page.
- When mapping the site by using the main navigation and the links within each page's content, we get the following results:

• Thereare many pages that do not direct you to other pages in the same site. However, they tend to be "dead-ends" because they are presenting you with an option other than to continue browsing the site. These include:

- Commit to something
- Buy something
- Donate

- Visit an associated site

• Some sections do not refer to other sections in the site.
• Some sections have many references within itself.
• Some sections reference most other sections.
• The page hierarchy does not seem to be very deep. They seem to have 3 to 4 levels at most.
• Most sites seem to be more wide than deep. These sites were 4 to 7 sections wide, with some sections consisting of only one page while other sections have continually increasing numbers of pages.
• Takethewalk.net consists of only 'commit' sections.

The second set of websites that we analyzed consists of:

• backyardchickens.com
• community-boating.org
• hikingforums.net
• dogster.com

Home Page:

- Backyardchickens.com gives a welcome message, says when they started and what they are there for. They suggest ways to get started for beginners. First option is basic information, second leads to details, and third points to community (forum).
They also show recent posts, "chicken coop", related links, and items for sale.
- community-boating.org states the mission of the organization and shows news, events and promotions. On the side bar they point to information about classes, hours and directions, camera live feed and e-mail newsletter (ways to get involved / how to start).
- hikingforums.net has a slideshow of pictures and has a preview of threads in the forum. It also displays links to latest and popular threads and allow for logging-in.
- dogster.com shows links to 4 featured articles, latest, news, popular questions, tip of the day, information on breeds, behavior and training, trending topics, facebook page fans, and photo gallery preview.

Menu/pages:

Backyardchicken.com has:

• Learning center: links to basic information, how-to pages, FAQs, forum, glossary, detailed and specific info.
• Section dedicated to coop design.
• Section dedicated to breeds.
• Forum.
• Recipes.
• Store.
• Gallery.
• About and Contact

Community-boating.org has:

• How to join page, with information on how to join specific programs and subsections of rates, facilities and gift certificates.
• Programs, with detailed information for each one.
• About, with information on different aspects of the organization.
• News and events.
• How to help: volunteer and donate.

Hikingforums.net has:
• Forums. All other sections point to somewhere within these forums.
• Cooking section, which has no content.
• Health and fitness.
• Hiking with kids.
• FAQ, blog and news

Dogster.com has:
• Breeds, with detailed information.
• Puppies, with relevant details and concerns.
• Health and care, information and suggestions.
• Food.
• Behavior and training.
• Adoption.
• Dogs 101.

Appendix I: Website Low Fidelity Testing

December 15th, 2011
WPI Rain Gardens Team

Explanation

We decided to construct a paper mockup of our website to test its usability with the stakeholders of the project. This allowed us to easily make changes without much effort for whatever suggestions they had. Also, since it was easy to implement, we could use it for testing early in the design process before we invested much time implementing things that we would later have to change at a higher fidelity level. Because it was implemented using note cards and sticky notes, the stakeholders themselves could easily move elements around the page and add anything they thought would be more appropriate for the website.

How the Mockup Works

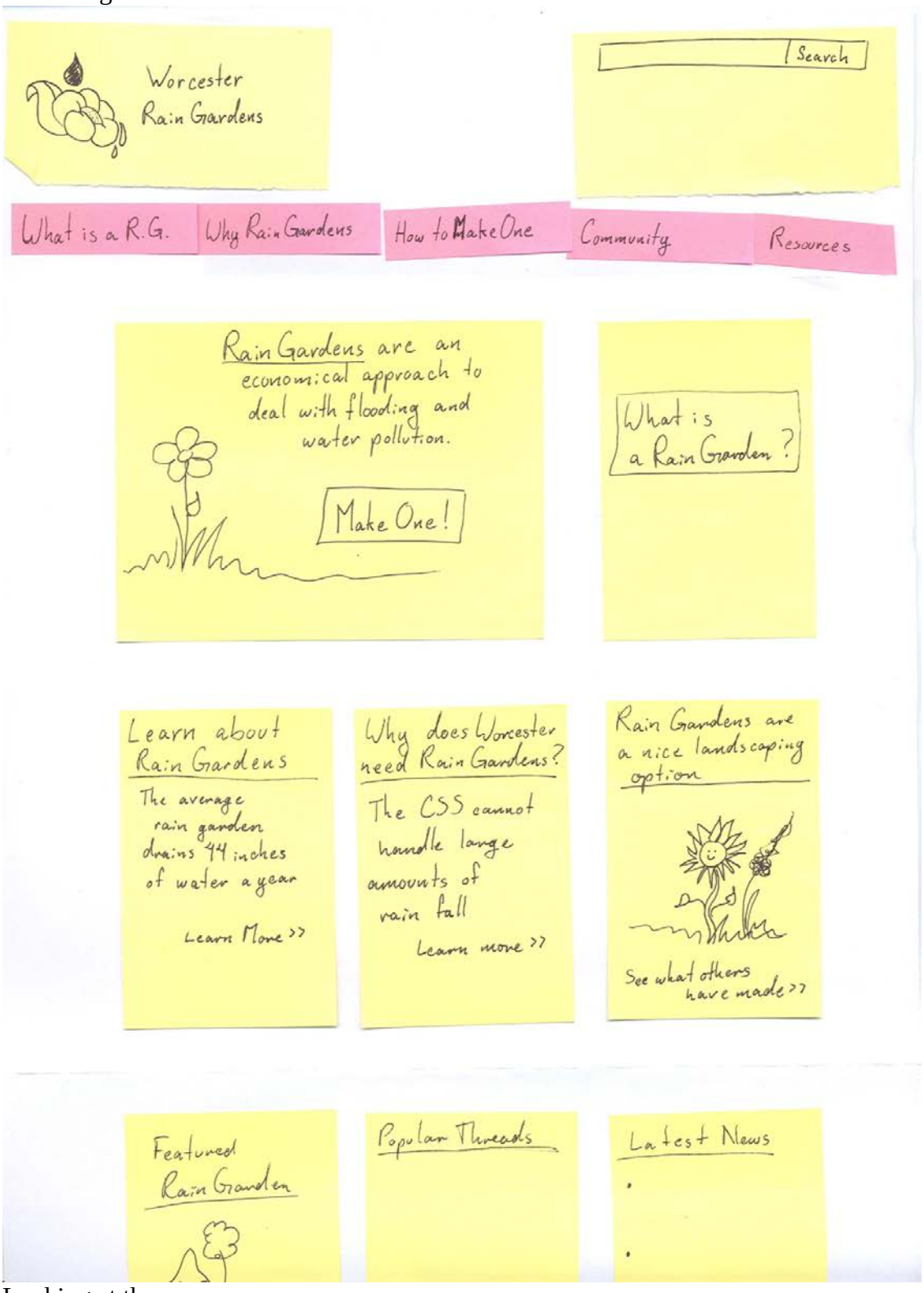
We had a piece of paper that contained the main navigation elements. When users looked at the main menu, we would show then note cards that simulate drop-down menus for each section of the website. When they clicked on a link, we would place other pages on top of the main piece of paper with content specific to the given page that the user would be viewing. The user could make suggestions or move things around and we would make changes accordingly. The pictures in the next few pages show the materials used in the paper mockup.

Findings

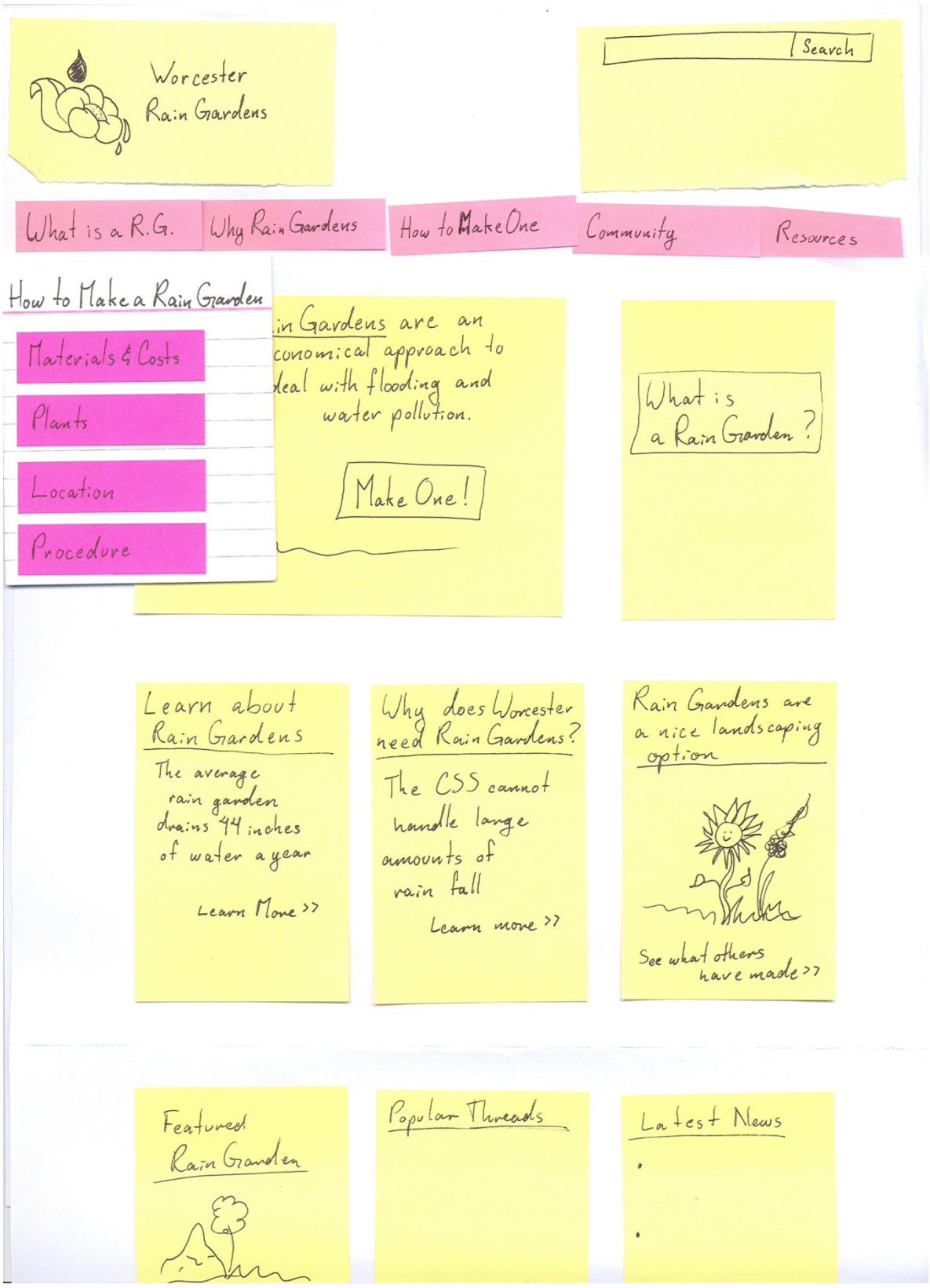
The main issues that we found in our tests was that it was not obvious enough, by giving a quick glance at the home page, what a rain garden is or how the user could learn more about it. Because of this, we made sure to include a picture of a rain garden at a prominent position, a quick summary of the message of our website, and obvious buttons where users could click to learn more information. We also had to make sure that it was clear a clear enough reason for why the visitor should make a rain garden, and we made sure to incorporate this in the short message found in the home page.

Pictures

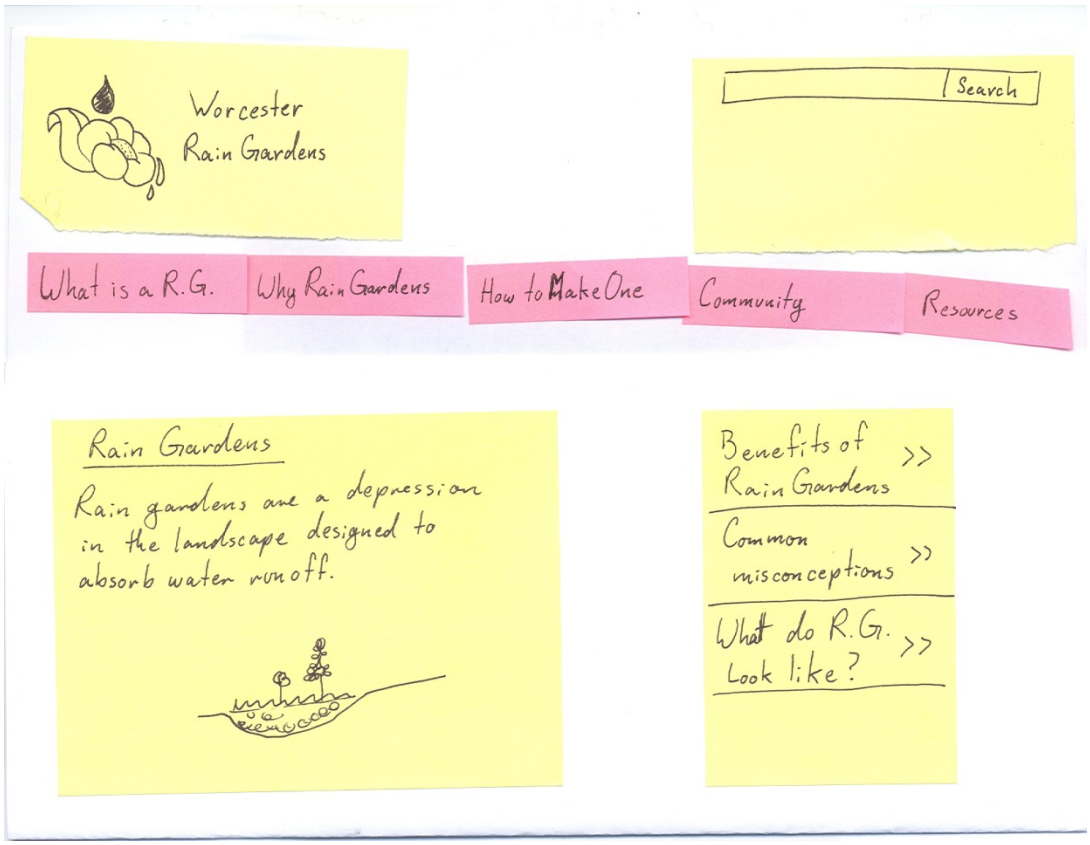
Home Page:



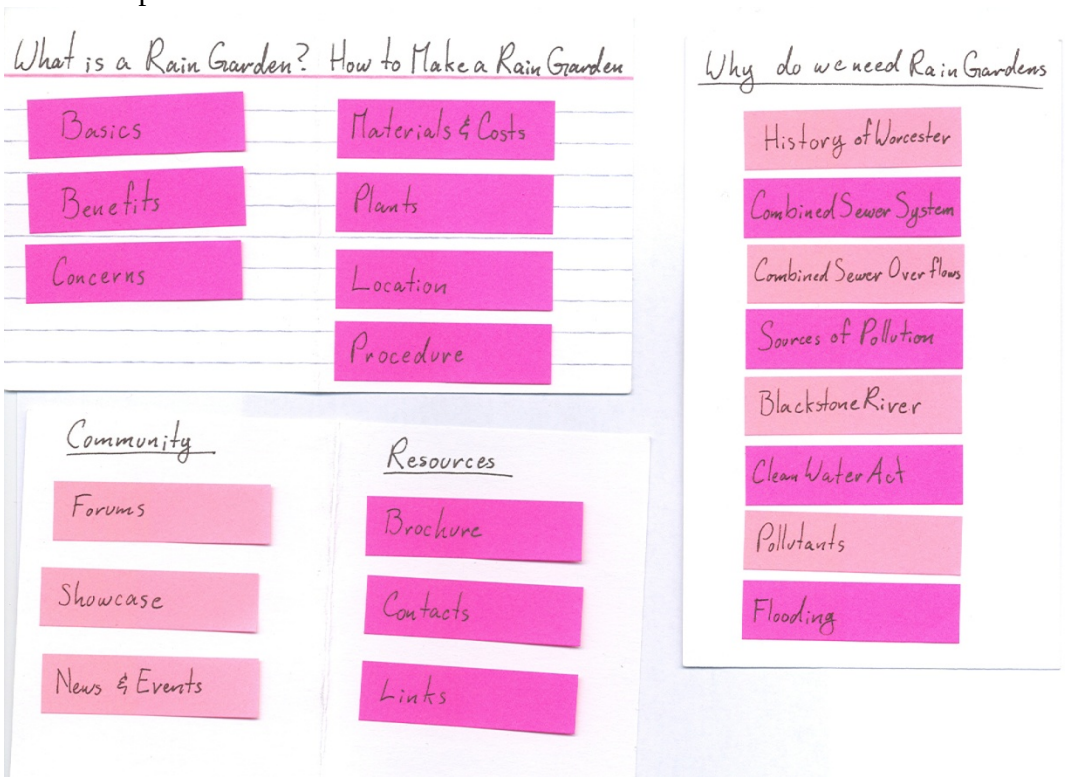
Looking at the menu:



Page with content example:



All the drop-down menus:



All the content pages:

Rain Gardens

Rain gardens are a depression in the landscape designed to absorb water runoff.

Benefits of Rain Gardens >>

Common misconceptions >>

What do R.G. Look like? >>

Benefits of Rain Gardens

- Prevent flooding
- Filter water
- Look nice
- Low maintenance

Common Misconceptions >>

Make a Rain Garden >>

Concerns

- Rain Gardens allow mosquitoes to grow.
  - Not true. Rain gardens allow the water to drain in less than 48 hours.
- Won't survive the winter.
  - Not true. Rain gardens can (and should) be made with natives plants accustomed to the region's weather.

See the benefits of R.Gs. >>

Make One >>

Things You will need:

- Backyard $ #
- Shovel $ #
- Soil $ #
- Plants $ #
- etc $ #

total $###

Find Resources >>

Next: choose plants

Plants (in Worcester): click for picture

- Plant 1
- Plant 2

Picture of plant.

Next choose a location

What you should look for: click for example

- Slope
- 10 ft. away from house

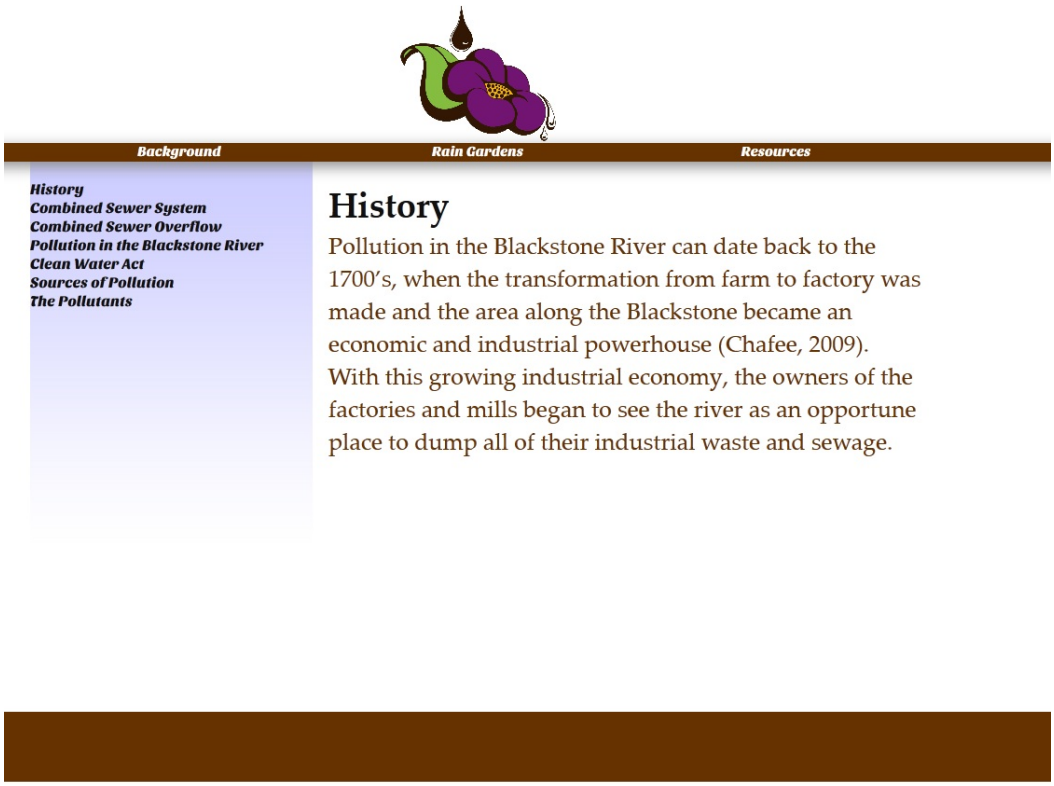
Example picture

Next: start digging

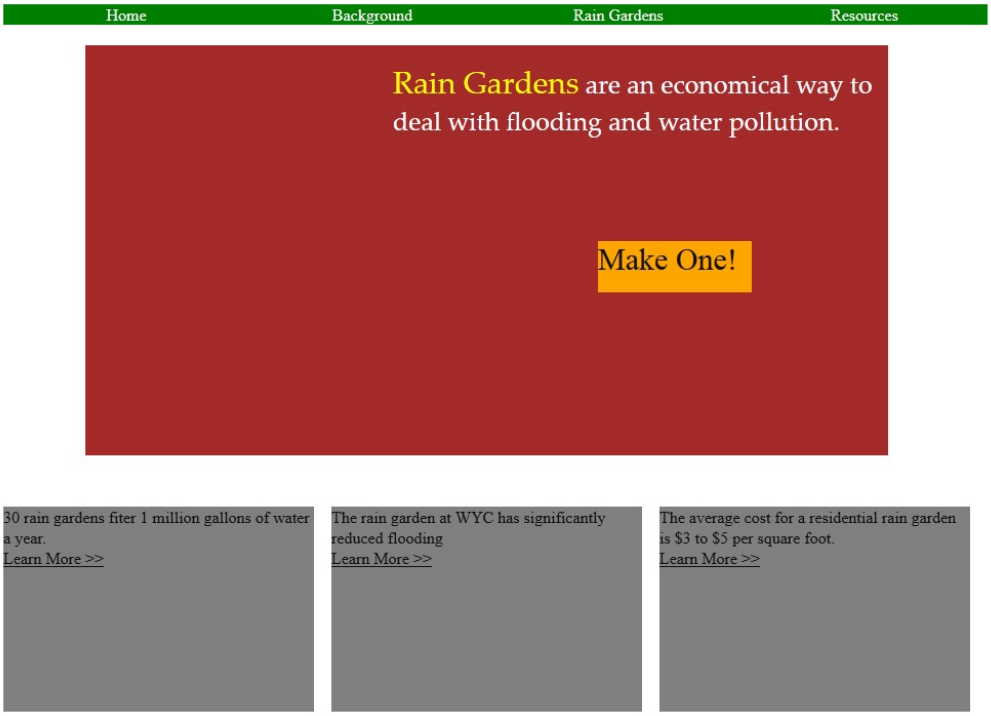
Appendix J: Website Progress

December 15th, 2011
WPI Rain Gardens Team

This document shows pictures the different designs that we went through before reaching the final product.


Background
Rain Gardens
Resources
History
Combined Sewer System
Combined Sewer Overflow
Pollution in the Blackstone River
Clean Water Act
Sources of Pollution
The Pollutants
History
Pollution in the Blackstone River can date back to the 1700's, when the transformation from farm to factory was made and the area along the Blackstone became an economic and industrial powerhouse (Chafee, 2009). With this growing industrial economy, the owners of the factories and mills began to see the river as an opportune place to dump all of their industrial waste and sewage.


Worcester Rain Gardens
Background
Rain Gardens
Benefits
Materials
Instructions
Resources
History
Pollution in the Blackstone River can date back to the 1700's, when the transformation from farm to factory was made and the area along the Blackstone became an economic and industrial powerhouse (Chafee, 2009). With this growing industrial economy, the owners of the factories and mills began to see the river as an opportune place to dump all of their industrial waste and sewage.
History
Combined Sewer System
Combined Sewer Overflow
Pollution in the Blackstone River
Clean Water Act
Sources of Pollution
The Pollutants


Home
Background
Rain Gardens
Resources
Rain Gardens are an economical way to deal with flooding and water pollution.
Make One!
30 rain gardens fiter 1 million gallons of water a year.
Learn More >>
The rain garden at WYC has significantly reduced flooding
Learn More >>
The average cost for a residential rain garden is $3 to $5 per square foot.
Learn More >>


WORCESTER RAIN GARDENS
Home
Rain Gardens
Why Worcester?
How to Make
Community
Resources
By making a Rain Garden at home, you help reduce flooding and water pollution.
Learn about Rain Gardens
30 rain gardens fiter 1 million gallons of water a year.
Learn More >>
Why does Worcester need Rain Gardens?
The rain garden at WYC has significantly reduced flooding
Learn More >>
Rain Gardens are a nice landscaping option
Take a look at what other have made.
Learn More >>
Featured Rain Gardens
Picture of a community member's rain garden here.
Go to Showcase >>
Popular Threads
Thread 1
Thread 2
Thread 3
Go to Forums >>
Latest News
Interesting story catchphrase.
Informative story catchphrase.
Illustrative story catchphrase.
Go to News & Events >>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Community
Resources
By making a Rain Garden at home, you help reduce flooding and water pollution.
What is a Rain Garden?
Why does Worcester need Rain Gardens?
Make a Rain Garden
Featured Rain Gardens
Picture of a community member's rain garden here.
Go to Showcase >>
Popular Threads
Thread 1
Thread 2
Thread 3
Go to Forums >>
Latest News
Interesting story catchphrase.
Informative story catchphrase.
Illustrative story catchphrase.
Go to News & Events >>
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Appendix K: Website Screenshots

December 15th, 2011
WPI Rain Gardens Team

This document contains screenshots of all the pages on one of the latest version of our website.


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Home
Rain Gardens
Why Worcester?
How to Make
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Relevant Information
Benefits of rain gardens >>
Common misconceptions about rain gardens >>
Why does Worcester need rain gardens? >>
What does a rain garden look like? >>
Make a rain garden >>
Rain Garden Basics
What is a Rain Garden?
A rain garden is a shallow depression built into the landscape and planted with perennial native plants. Rain gardens are an economical and viable alternative for addressing flooding and water pollution problems associated with rain water runoff. They are designed to capture water from impervious surfaces such as roofs, driveways, and sidewalks.
How is a Rain Garden different from other gardens?
It is designed to allow water to pool during and after a storm so that it may slowly filter into the ground. This is achieved through the soil composition, which consists of a mixture of sand, topsoil and compost. As the rain water passes through the rain garden it undergoes a natural microbial process that removes pollutants and results in cleaner water. All this prevents the storm drains from being overwhelmed by large amounts of water and also helps reduce pollution in the water before it reaches lakes and rivers.
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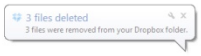
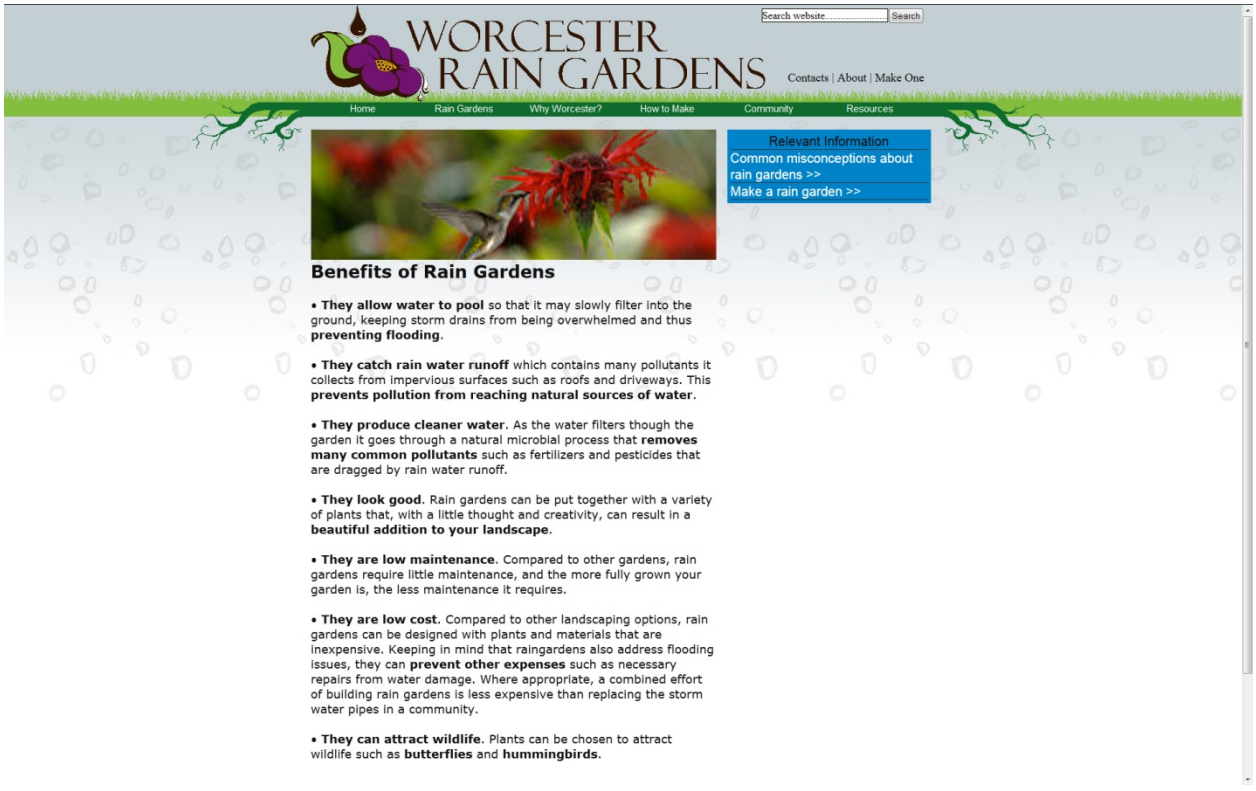

3 files deleted
3 files were removed from your Dropbox folder.


Search website
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Common misconceptions about rain gardens >>
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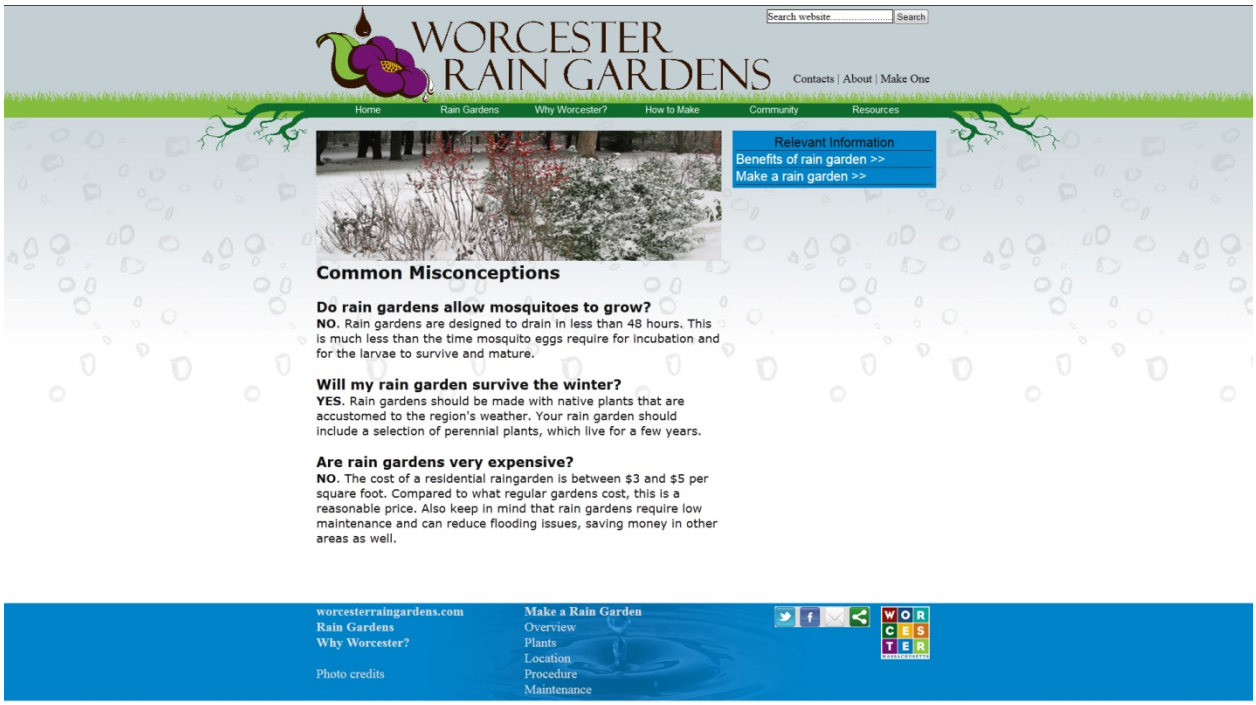
Benefits of Rain Gardens
• They allow water to pool so that it may slowly filter into the ground, keeping storm drains from being overwhelmed and thus preventing flooding.
• They catch rain water runoff which contains many pollutants it collects from impervious surfaces such as roofs and driveways. This prevents pollution from reaching natural sources of water.
• They produce cleaner water. As the water filters though the garden it goes through a natural microbial process that removes many common pollutants such as fertilizers and pesticides that are dragged by rain water runoff.
• They look good. Rain gardens can be put together with a variety of plants that, with a little thought and creativity, can result in a beautiful addition to your landscape.
• They are low maintenance. Compared to other gardens, rain gardens require little maintenance, and the more fully grown your garden is, the less maintenance it requires.
• They are low cost. Compared to other landscaping options, rain gardens can be designed with plants and materials that are inexpensive. Keeping in mind that raingardens also address flooding issues, they can prevent other expenses such as necessary repairs from water damage. Where appropriate, a combined effort of building rain gardens is less expensive than replacing the storm water pipes in a community.
• They can attract wildlife. Plants can be chosen to attract wildlife such as butterflies and hummingbirds.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Common Misconceptions
Do rain gardens allow mosquitoes to grow?
NO. Rain gardens are designed to drain in less than 48 hours. This is much less than the time mosquito eggs require for incubation and for the larvae to survive and mature.
Will my rain garden survive the winter?
YES. Rain gardens should be made with native plants that are accustomed to the region's weather. Your rain garden should include a selection of perennial plants, which live for a few years.
Are rain gardens very expensive?
NO. The cost of a residential raingarden is between $3 and $5 per square foot. Compared to what regular gardens cost, this is a reasonable price. Also keep in mind that rain gardens require low maintenance and can reduce flooding issues, saving money in other areas as well.
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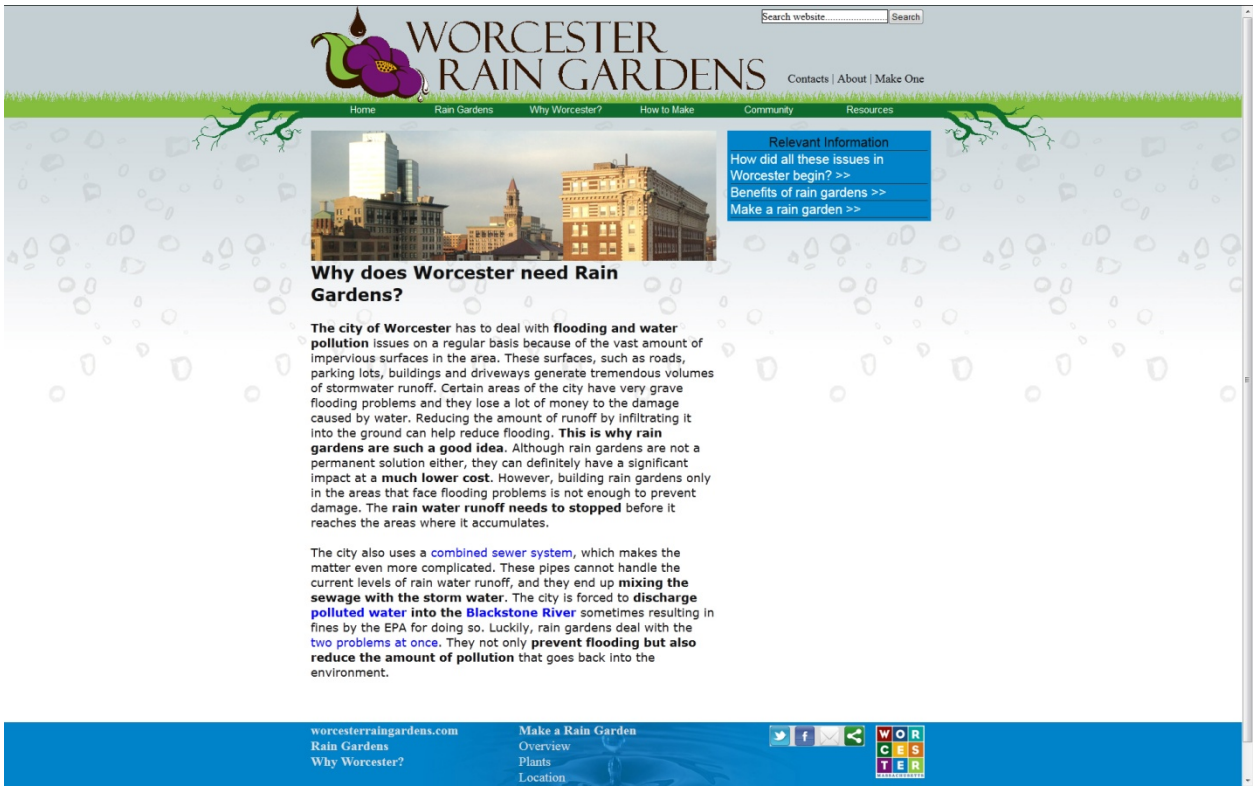
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How did all these issues in Worcester begin? >>
Benefits of rain gardens >>
Make a rain garden >>
Why does Worcester need Rain Gardens?
The city of Worcester has to deal with flooding and water pollution issues on a regular basis because of the vast amount of impervious surfaces in the area. These surfaces, such as roads, parking lots, buildings and driveways generate tremendous volumes of stormwater runoff. Certain areas of the city have very grave flooding problems and they lose a lot of money to the damage caused by water. Reducing the amount of runoff by infiltrating it into the ground can help reduce flooding. This is why rain gardens are such a good idea. Although rain gardens are not a permanent solution either, they can definitely have a significant impact at a much lower cost. However, building rain gardens only in the areas that face flooding problems is not enough to prevent damage. The rain water runoff needs to stopped before it reaches the areas where it accumulates.
The city also uses a combined sewer system, which makes the matter even more complicated. These pipes cannot handle the current levels of rain water runoff, and they end up mixing the sewage with the storm water. The city is forced to discharge polluted water into the Blackstone River sometimes resulting in fines by the EPA for doing so. Luckily, rain gardens deal with the two problems at once. They not only prevent flooding but also reduce the amount of pollution that goes back into the environment.
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- Benefits of rain gardens >>
- Make a rain garden >>

History of Pollution and Flooding

Pollution in the Blackstone River can date back to the 1700's, when the transformation from farm to factory was made and the area along the Blackstone became an economic and industrial powerhouse (Chafee, 2009). With this growing industrial economy, the owners of the factories and mills began to see the river as an opportune place to dump all of their industrial waste and sewage.

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Combined Sewer System

A combined sewer system (CSS) is an old infrastructure designed to collect rainwater runoff and domestic sewage in a single pipe system. Worcester has such system in the core of downton. It is collected into the sewer facility on Quinsigamond Avenue and then transported to the Upper Blackstone Water Pollution Abatement District (UBWPAD) off Route 20 on the southern border of the city, making it the largest single source of pollution entering the Blackstone River.

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Combined Sewer Overflows

During times of heavy precipitation, like rain or the melting of a significant amount of snowfall, the volume of wastewater can exceed what these water treatment plants normally handle. When the wastewater volume exceeds the capacity of the combined sewer system or treatment plant, cities are forced to dump the waste directly into the river (Water Pollution Prevention Program, 2011). These overflows are referred to as combined sewer overflows (CSOs).

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Point and Non-Point Source Pollution

Point source pollution comes from a discrete source or single outlet such as a discharge pipe at an industrial plant or wastewater treatment plant (DEP, 2011). Opposite from point source pollution, the pollution coming from storm water runoff is called non-point source pollution because it is difficult to pin point and control, and occurs wherever there is human activity. Storm water runoff is especially harmful because it does not pass through treatment plants; it is channeled directly into the river.

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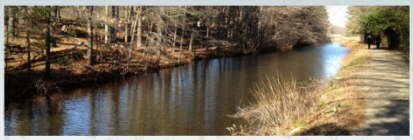

Relevant Information
- Pollutants >>
- Make a rain garden >>
- Benefits of rain gardens >>

Pollution in the Blackstone River

In the early 1990's, the Environmental Protection Agency (EPA) released a statement saying that the Blackstone River is "the most polluted river in the country with respect to toxic sediments" (Kerr, 1990). In the water quality report done from 2003 to 2007, the condition of the segment of the Blackstone River, which passes through Worcester, was very poor. The report stated that the aquatic life, primary contact, secondary contact and aesthetics were all impaired (DEP, 2011). The factors that lead to the impairment of the water quality are derived by many of the pollutants being carried into the river from sewage discharge and storm water runoff.

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- Pollutants from rain water runoff >>
- Flooding in Worcester >>
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The Clean Water Act

The Clean Water Act of 1972 was put into effect to help restore and maintain the chemical, physical, and biological integrity of the nation's waters by preventing point and non-point pollution sources (DEP, 2011).

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Benefits of rain gardens >>

Pollutants carried by Rain Water Runoff

->Phosphorous
->Nitrogen
->Pet waste
Nutrients and bacteria carried into the environment by storm water runoff affect the health balance of the ecosystem. Pet waste carries high levels of bacteria, such as E. Coli.

->Zinc
->Cadmium
->Copper
->Chromium
->Lead
Heavy metals also alter the chemical balance of the ecosystem.

->Motor oil
->Car leakages
Motor oil and car leakages do not dissolve in water and are very harmful to the environment.

->Fertilizers
->Pesticides
Fertilizers and pesticides cause excess algae to grow in the water, eating up all the oxygen that the rest of the aquatic life requires.

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Flooding Problems in Worcester

Worcester floods. A lot.
Because Worcester sits on top of seven hills, when it rains the water tends to collect in the low lying areas of the city.

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Find resources >>
Making a rain garden is pretty simple. It mainly consists of digging a shallow depression in the ground and planting perennial native plants. Maintenance is less than that of a regular garden.
Things you will need:
• Shovel ~ $10
• Plants ~ $250
• Topsoil and/or compost ~ $5
• Mulch ~ $5
• Area of about 100 square feet ~ no additional cost
TOTAL ~ $270
Next: choose plants >>
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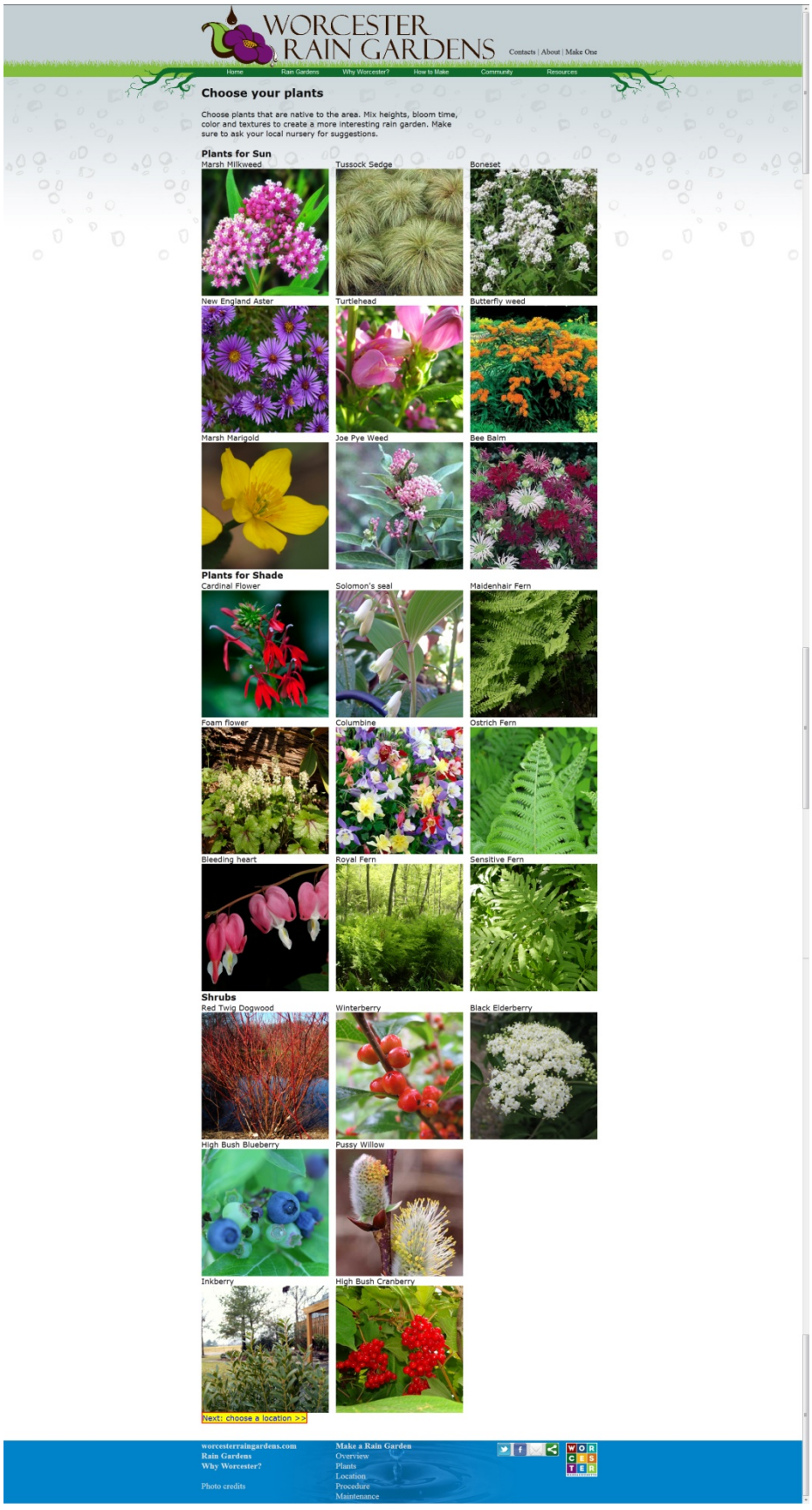
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Choose your plants
Choose plants that are native to the area. Mix heights, bloom time, color and textures to create a more interesting rain garden. Make sure to ask your local nursery for suggestions.
Plants for Sun
Marsh Milkweed
Tussock Sedge
Boneset
New England Aster
Turtlehead
Butterfly weed
Marsh Marigold
Joe Pye Weed
Bee Balm
Plants for Shade
Cardinal Flower
Solomon's seal
Maidenhair Fern
Foam flower
Columbine
Ostrich Fern
Bleeding heart
Royal Fern
Sensitive Fern
Shrubs
Red Twig Dogwood
Winterberry
Black Elderberry
High Bush Blueberry
Pussy Willow
Inkberry
High Bush Cranberry
Next: choose a location >>
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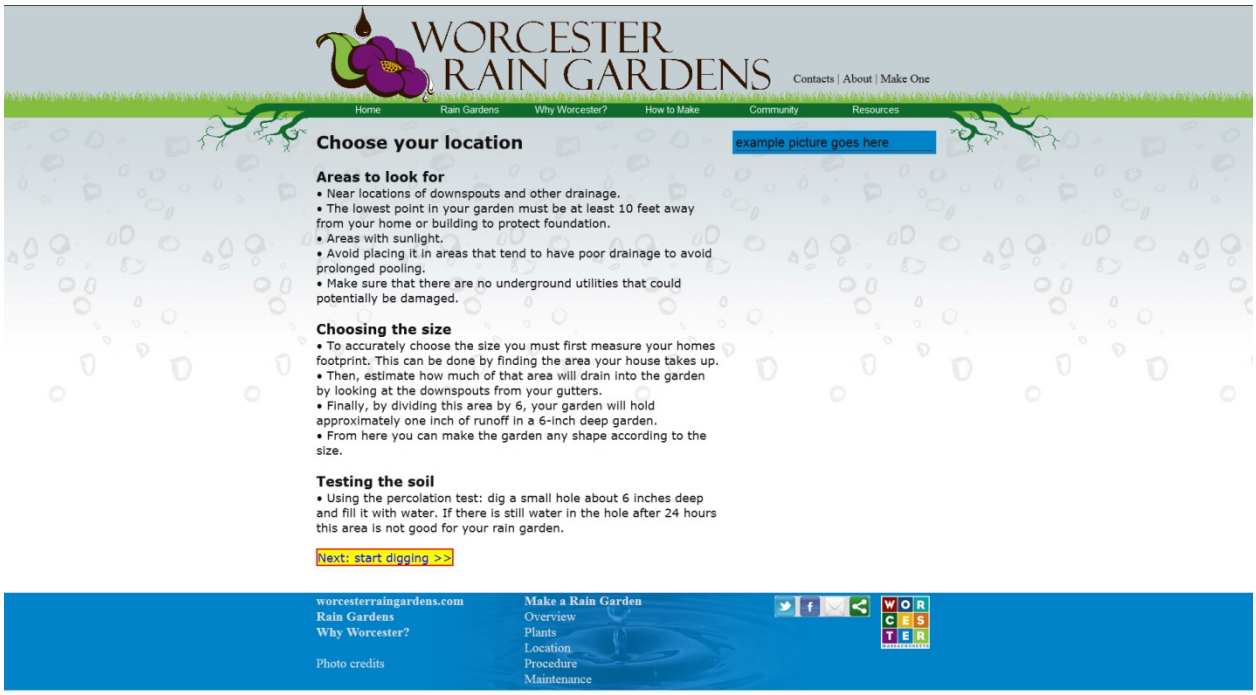
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Choose your location
example picture goes here
Areas to look for
• Near locations of downspouts and other drainage.
• The lowest point in your garden must be at least 10 feet away from your home or building to protect foundation.
• Areas with sunlight.
• Avoid placing it in areas that tend to have poor drainage to avoid prolonged pooling.
• Make sure that there are no underground utilities that could potentially be damaged.
Choosing the size
• To accurately choose the size you must first measure your homes footprint. This can be done by finding the area your house takes up.
• Then, estimate how much of that area will drain into the garden by looking at the downspouts from your gutters.
• Finally, by dividing this area by 6, your garden will hold approximately one inch of runoff in a 6-inch deep garden.
• From here you can make the garden any shape according to the size.
Testing the soil
• Using the percolation test: dig a small hole about 6 inches deep and fill it with water. If there is still water in the hole after 24 hours this area is not good for your rain garden.
Next: start digging >>
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Making your rain garden
Digging
• Most at home rain gardens can be dug with just a shovel.
• For a flat area, you can dig about a 6-inch depression.
• If the area is sloped, you will still dig about 6-inches deep but you may need to contruct a small barrier at the low end of the garden.FIX THIS
Planting
• Once the rain garden has been dug, either topsoil, compost, or a combination needs to be added.
• Perennials, shrubs, grasses, and small trees are the most commonly used plants but these plants vary depending on your location.
• Finally, add a layer of shredded hardwood mulch to help prevent the growth of weeds and to conserve moisture should be the top layer of the garden.
Next: maintenance for your rain garden >>
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Maintaining a rain garden is very much like maintaining any normal form of landscaping. Until the plants are established in their environment, they will need to be watered during dry periods. Weeding should be performed as needed or to your own preference.
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Showcase >>
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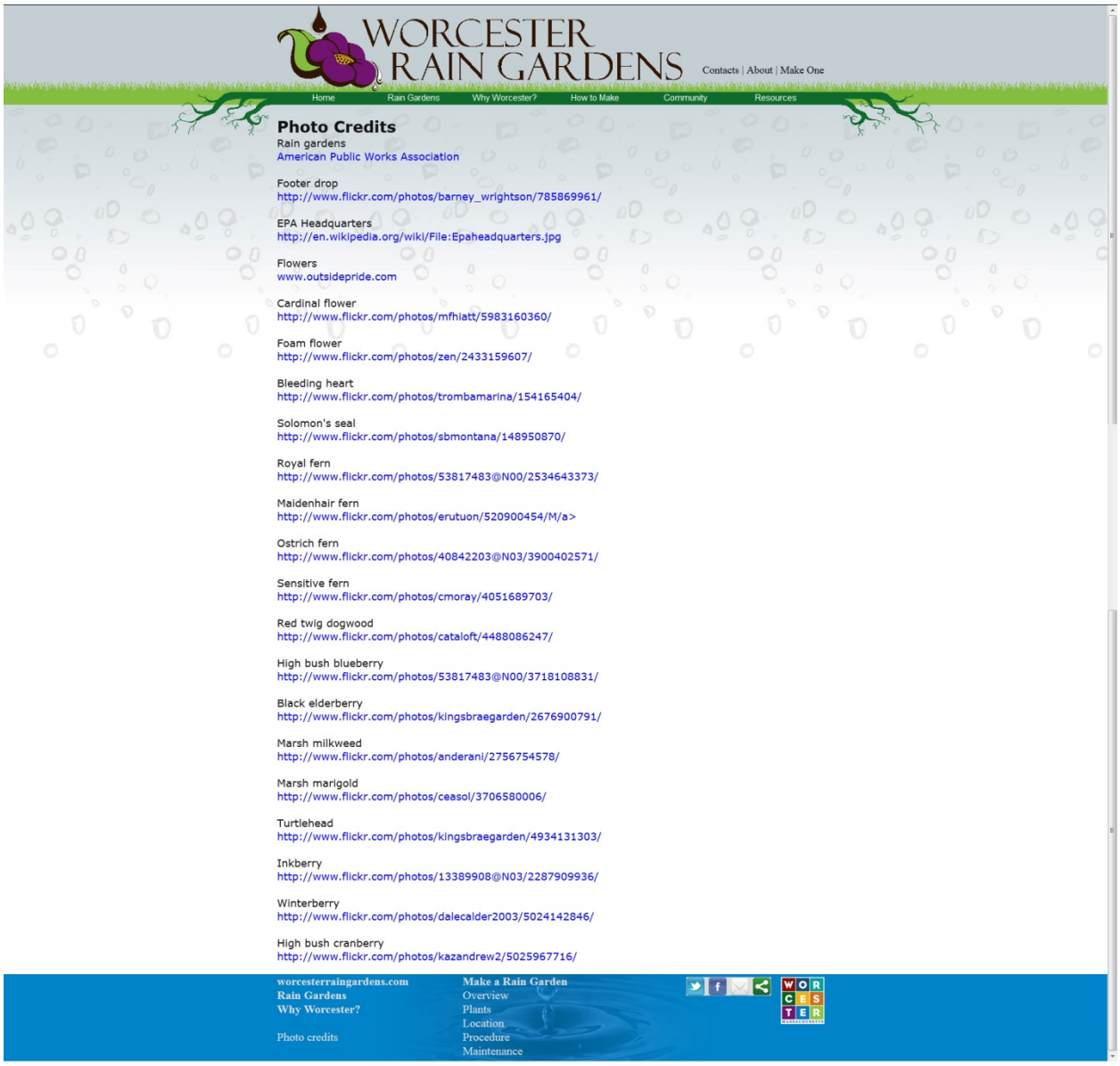
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American Public Works Association
Footer drop
http://www.flickr.com/photos/barney_wrightson/785869961/
EPA Headquarters
http://en.wikipedia.org/wiki/File:Epaheadquarters.jpg
Flowers
www.outsidepride.com
Cardinal flower
http://www.flickr.com/photos/mfhiatt/5983160360/
Foam flower
http://www.flickr.com/photos/zen/2433159607/
Bleeding heart
http://www.flickr.com/photos/trombamarina/154165404/
Solomon's seal
http://www.flickr.com/photos/sbmontana/148950870/
Royal fern
http://www.flickr.com/photos/53817483@N00/2534643373/
Maidenhair fern
http://www.flickr.com/photos/erutuon/520900454/M/a>
Ostrich fern
http://www.flickr.com/photos/40842203@N03/3900402571/
Sensitive fern
http://www.flickr.com/photos/cmoray/4051689703/
Red twig dogwood
http://www.flickr.com/photos/cataloft/4488086247/
High bush blueberry
http://www.flickr.com/photos/53817483@N00/3718108831/
Black elderberry
http://www.flickr.com/photos/kingsbraegarden/2676900791/
Marsh milkweed
http://www.flickr.com/photos/anderani/2756754578/
Marsh marigold
http://www.flickr.com/photos/ceasol/3706580006/
Turtlehead
http://www.flickr.com/photos/kingsbraegarden/4934131303/
Inkberry
http://www.flickr.com/photos/13389908@N03/2287909936/
Winterberry
http://www.flickr.com/photos/dalecalder2003/5024142846/
High bush cranberry
http://www.flickr.com/photos/kazandrew2/5025967716/
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Appendix L: Website Documentation

www.worcesterraingardens.com
v1.0 – December 15th, 2011
WPI Rain Gardens Team

1. Files

- This website uses HTML, CSS and PHP.
- All files are saved as PHP files.
- All pages must include before.php before the content and after.php after the content. These files include the **top**, **menu** and **footer** that are included in every page of the website. They also contain the document declaration and the **html**, **head** and **body** tags.
- There is a single style sheet, style.css, which contains all of the styles for the entire website.
- All pictures for the website are stored in the **/images** subdirectory.

2. Layout

- All major divisions on the page are contained in a wrapper, which allows including backgrounds which cover the entire screen regardless of screen size.
- All major divisions have a width of 960 pixels and are centered on the screen. This ensures that the content fits on most computer screens and attempts to display the site as similarly as possible.
- We used a grid system to place the elements on the page.
    - We limited the number of column divisions to a maximum of three.
    - The gutter space between column divisions is 17 pixels wide.

2.1 General Layout

- The **top** division contains:
    - an image with the logo and name of the website, which is aligned to the left.
    - a search bar, which is aligned to the top right corner.
    - a utilities menu, which is aligned to the bottom right corner.
- The **menu** division contains a <ul> element whose list items are the main links on the main menu. Each <li> contains another <ul> which is the drop-down menu for that particular option.
- The **footer** division two columns and a black area to the right where the Worcester logo and the 'share' buttons were included.
- The columns in the **footer** contain important navigation links.

2.2 Home Page Layout

- The **header** contains striking image with a short sentence that summarizes the main message of the website.
- The **front** division in the homepage contains important links to the rest of the website.
    - This division has a fixed size because the **.news** elements are positioned relative to this division. This means that the container will not expand as the **.news** elements overflow its borders.
- All of the **.news** share style characteristics in this class. Each of them has particular characteristics given to its own identifier.

2.3 Content Page Layout

- The **content** division holds the entire page's content.

- The **info** division contains the main information of the page.
- The **picture** is there to ensure that every content page has a relevant image that illustrates its content.
- The **links** division has links to information elsewhere on the site that is relevant to the page's content.

3. Known issues

- The search bar is not implemented.
- There are no About, Contact, Resources or any of the community pages.
- The background image for the menu, which overflows its container, causes a horizontal scrollbar to appear when the browser's viewport becomes smaller than its width. However, the image does maintain its correct position in relation to the other elements in the page.

NOTE: To get a better understanding on the ideas by which this website was created, read Chapter 6 of the *Worcester Rain Gardens Promotional Campaign* IQP report that can be found online through WPI.

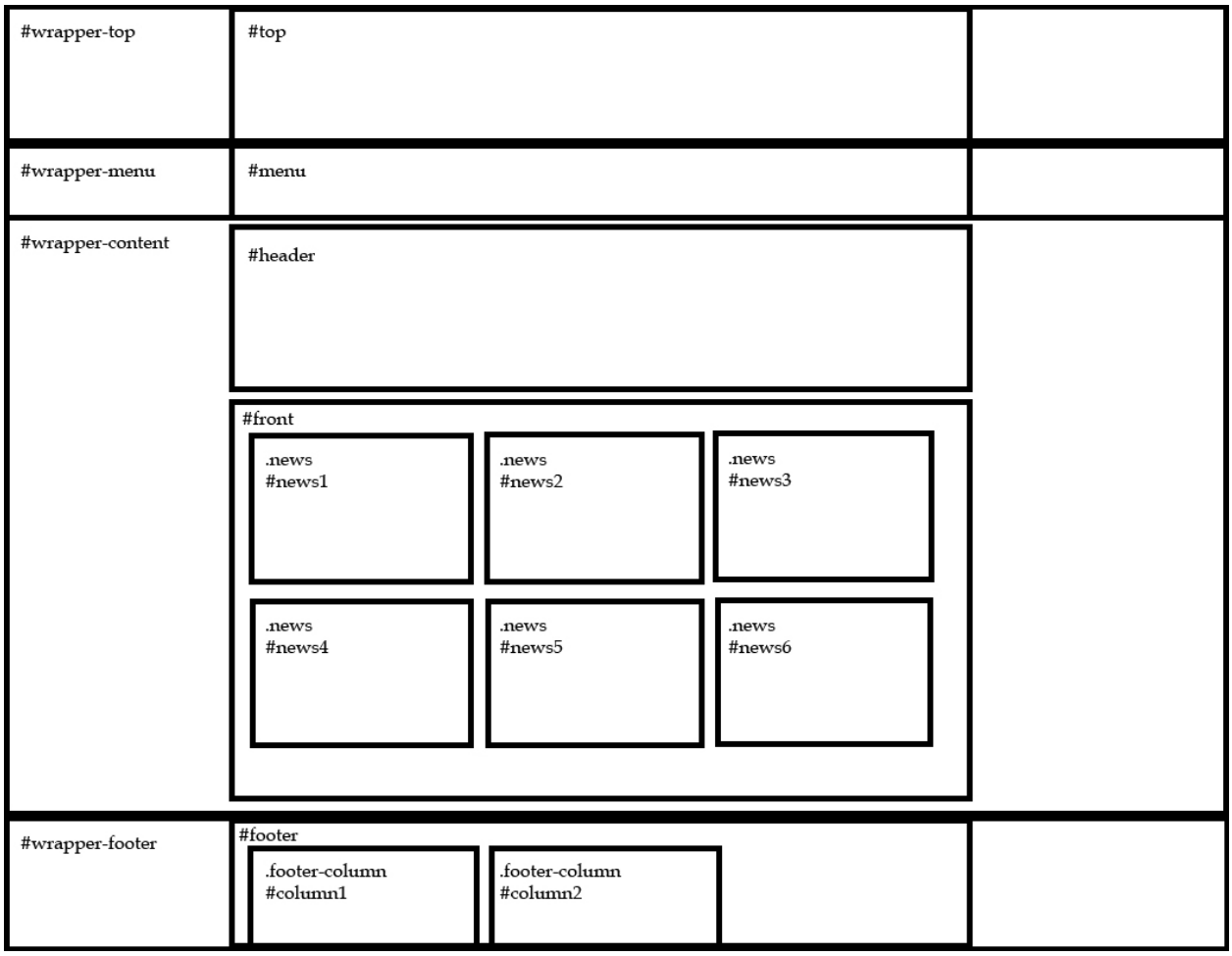

Figure 1: General identifiers of the home page

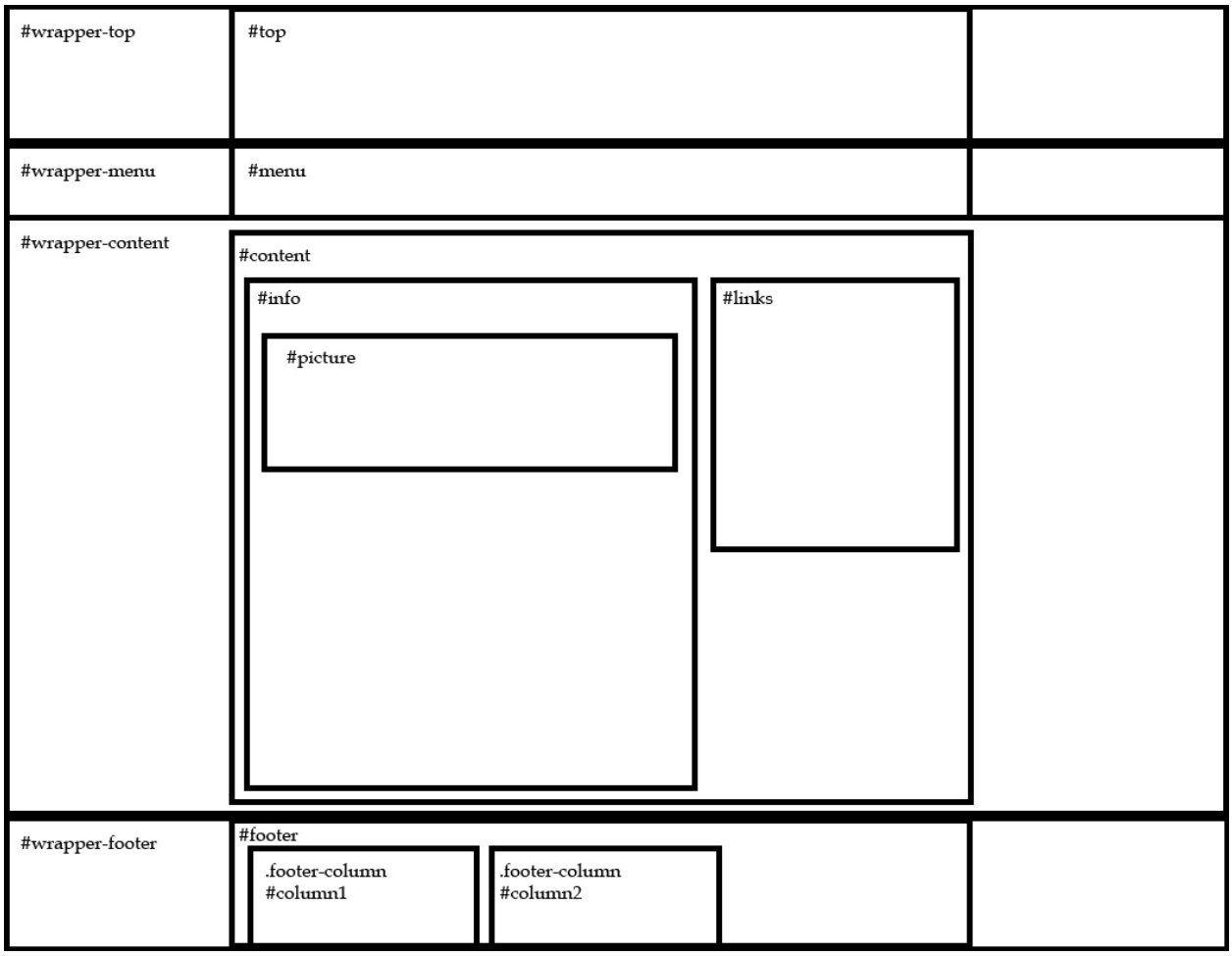

Figure 2: General identifiers of a content page

Appendix M: Website Recommendations

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Web 2.0

Currently, all the content in the website is static content. However, we included a section in the website where features such as a forum and a blog could be included. We strongly recommend that these sections be implemented so as to keep the website active. By having an active community in the website it can encourage others to be interested in the site and also to promote the website to a wider audience. Not having these features in the site would make the website seem outdated and would lead to it becoming obsolete in very little time. Keep in mind that having these features would need at least one person to regularly update and moderate the content. The added effort is worthwhile since users will see that someone cares enough about the website to update it regularly and therefore they should also care enough about the website to visit it regularly.

Once some of these features have been implemented, the home page should be updated. We commented out the places where we think important information about the website's community should be displayed. The website documentation file has helpful information for recovering these items onto the home page.

Things to include (in order of priority):

• *ShareThis* Buttons

This allows visitors to spread the word about the website. This should be easily done through http://sharethis.com/ . We left an element in the footer, commented out, where these buttons should be placed. It has the name of 'sharing' in the **id** attribute.

• News and Events

This section is meant to show the progress that is being made in addressing the flooding and water pollution problems in the city of Worcester, especially through the use of rain gardens. Through this section users can also get a better idea on the positive effects of rain gardens, what others have done, what their own rain gardens could look like and it is also a way through which they could get involved in community events.

• Worcester Rain Gardens FaceBook Page:

Having a page on FaceBook is second after a forum for creating an online community around an issue. The reason this recommendation takes precedence over a forum is that it is easier for users to get involved with it (since it is very likely that they already have a FaceBook account) and users tend to check their FaceBook accounts regularly, something that is less likely to happen on a new forum. Through this FaceBook pages, users can be updated on news and events and it should also provide a section where they could hold discussions.

• Forum

A forum allows for a centralized place where users could hold discussions about rain gardens. Since it is in the website, it helps keep users within the context and allows them to spend more of their attention in the discussion. However, to ensure that a forum community will continue to exist for a reasonable amount of time, it is recommended a forum be set up in the website only after about 200 members are willing to register for it. For this reason we recommend having the FaceBook first and, after enough members are involved, moving the

community to a forum. Sections that could be included in the forum are: Plants Selection and Maintenance, Help for Building a Rain Garden, Flooding and Water Pollution, Share your Pictures, General Discussion.

• **Showcase**

This is a section where users could upload pictures of their rain gardens and other users could rate them. This would create some friendly competition among users since the winning rain garden (perhaps weekly) would have their picture posted on the website's home page. However, this section is perhaps the most difficult to implement and it can only be effective after an active community has already been established.

Other Recommendations

There are certain things that we wish could have spent more time working on. We will explain them in this section.

Search Bar

When users are looking for specific information they sometimes feel more comfortable searching by keywords through a search bar. This is especially important on websites with large amounts of content but, although our website is not very big, this feature would still provide convenience to some of the users. We left a space for the search bar at the top of the page on a section that is commented out and has the **id** 'search'. We do not really know how much effort goes into incorporating this into our site, but we know that it can be done through Google (http://www.google.com/sitesearch/).

Revise Content

The "Why Worcester?" section needs to be revised. All the pages have relevant information, but we were aiming to combine them into three 3 or 4 pages so that it was not as confusing to browse and read through.

The "How To Make" section can be improved in terms of its readability. Having pictures for each section would help its aesthetic appeal and also to illustrate the instructions being given.

Add Resources

We believe that partnerships can be formed with nurseries and other local business where they could provide discounts or learn about rain gardens to educate their customers and, in turn, we would refer our users to their business.

Put the Video in the Website

The video is a powerful tool for getting people interested in the issues of flooding and water pollution in Worcester. It would fit nicely in the overview page of the "Why Worcester?" section.

Breadcrumbs

These help the users get a sense of orientation and where they are in the website. They are easy to implement, it just requires some time to go through and add them to every page.